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SOME WORM INFESTATIONS OF MAN IN AUSTRALIA.[1]

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THESE observations are concerned mainly with trichostrongyle worms and with *Strongyloides stercoralis*; they were made in North Queensland, but it is unlikely that any of the worms are confined to the far north.

1.—INFESTATIONS WITH TRICHOSTRONGYLE WORMS.

Trichostrongyle worms are nematode worms of the subfamily Trichostrongylinæ. From time to time in the work of the Australian Hookworm Campaign

strongyle eggs longer than those of hookworms and resembling eggs of the genus *Trichostrongylus* have been noticed and speculated on. For instance, in the final report of the Australian Hookworm Campaign, 1924 (unpublished), it is stated that "ova which were probably those of *Trichostrongylus orientalis*, were found in a few instances; the adult worm was never recovered, in spite of repeated efforts with various drugs." More recently Dr. H. R. Pearson, Dr. Cecil Cook and others noted these eggs during hookworm surveys in North Queensland.

Subsequently, in the course of hookworm survey work on the Atherton Tableland in 1928, these eggs were again noticed, and some fæcal specimens were sent to the Australian Institute of Tropical Medicine at Townsville, where they were cultured with earth. Detailed examination of the third stage larvæ obtained confirmed the surmise that the eggs belonged to worms of the genus *Trichostrongylus*. All attempts to obtain adult worms from infested persons by the administration of anthelminthics

failed; the practical difficulties with persons who are not in hospital, are very great.

Experiments with Goats.

It was thought that the worms might perhaps not be *Trichostrongylus orientalis*, but species of the genus normally inhabiting sheep, and it was decided to attempt to obtain the adults by feeding the third stage larvæ to young goats. Goats in Townsville all become infested with various trichostrongyles, but it was found that during the dry season kids about a fortnight old are free from these worms and can be kept so if isolated on uninfected ground where they are fed with milk from a baby's bottle. The experiments were facilitated by the almost complete absence of rain throughout and the parched condition of the ground.

The larvæ fed to the experimental kids came mainly from one source, a family, N., of English descent, living on a sheep property on the Atherton Tableland, in which district they had lived all their lives. In the two parents no infection was found, but the four boys, aged seven to fifteen years, all had ova of trichostrongyle type in their fæces. Some dozens of the third stage larvæ obtained by fæcal culture from these boys were examined and found to belong to the genus *Trichostrongylus*. To one only of the experimental goats a very few larvæ from other sources were fed; these came from small fæcal specimens of eight persons, of as many families, living at Mareeba. Here there was no association with sheep, but a superabundance of goats. A few larvæ cultured from several of these specimens were also examined and found to be of the genus *Trichostrongylus*. The fæcal specimens from all these people, which were carefully obtained and free from contamination with earth, were forwarded to Townsville and at once cultured with helminthologically sterile earth. The larvæ were isolated in clean water by means of Baermann funnels and fed to the kids with milk.

Four pairs of kids were used, each pair from a different mother; one pair was about three weeks old when separated from the mother, the rest less than a fortnight. To one kid of each pair larvæ of human origin were fed, the other serving as a control. All the mothers, which were old goats, harboured *Hæmonchus contortus* (Rud.), *Trichostrongylus colubriformis* (Giles) and *Trichostrongylus extenuatus* (Railliet) and most of them *Œsophagostomum columbianum* Curtice, *Strongyloides papillosus* (Wedl) and *Trichuris ovis* (Abildgaard). All these worms were in small numbers in every instance.

That *Trichostrongylus instabilis* (Railliet) is a synonym of *Trichostrongylus colubriformis* (Giles) as determined by Clayton Lane is here assumed.

Coccidial oocysts were also invariably present; these were examined at all stages of extracorporeal development and agreed well in structure and measurements with the descriptions of *Eimeria faurei* (Moussu and Marotel).

The event proved that all the eight kids at the time of their isolation had escaped infection with all strongyle worms; but all had already been infected with *Eimeria faurei*; six of them had been infected with *Strongyloides papillosus*, the remaining pair of kids remaining free throughout from this worm; and two kids, the oldest pair, had been infected with *Trichuris ovis*. The fæces both of the controls and of the kids to which larvæ were fed, was examined repeatedly by centrifugal flotation for ova and by the much more delicate method of culture of large samples for larvæ. Ova and larvæ of strongyle worms remained absent throughout the experiments from the fæces of all the controls; from the other kids, to which administration of larvæ began when they were from five to nine weeks old, strongyle larvæ were not cultured earlier than twenty days after the first feed. Some of the controls were eventually killed and the absence of strongyle worms confirmed.

The kids to which larvæ were fed were killed about five weeks after the last feed and the results of methodical collection of worms at autopsy were as follows.

Kid A.—The larvæ fed consisted of some hundreds from the N. family cultured from specimens obtained in May and in June, 1928; a few score larvæ from the eight Mareeba cases; some thousands of larvæ cultured from the kid's own fæces six weeks after the first feed of larvæ. The worms found at autopsy were: from the abomasum 62 specimens of *Hæmonchus contortus* and 17 of *Trichostrongylus*; from the small intestine about 1,300 *Trichostrongylus*. All the male *Trichostrongylus*, 587 in number, were examined in detail after clearing in phenol; all those from the small intestine and two from the abomasum were *Trichostrongylus colubriformis*. The other four males in the abomasum were *Trichostrongylus extenuatus*. The female *Trichostrongylus* were not identified as to species.

Kid B.—The larvæ fed, guessed as some hundreds in number, were cultured from fæces obtained from the four N. boys in September, 1928. At autopsy 299 *Trichostrongylus* were recovered from the small intestine and one female one from the abomasum. All the males were *Trichostrongylus colubriformis*. No *Strongyloides* were found, though a few larvæ and free living adults of *Strongyloides papillosus* had been cultured from the fæces.

Kids C and D.—The larvæ fed, in approximately equal numbers, to each kid, were cultured from large specimens from the N. boys, obtained in October, 1928. The autopsy on Kid C yielded in the abomasum seven *Trichostrongylus*, of which one was a male of the species *extenuatus*; in the small intestine 610 female *Trichostrongylus* and 572 males, which were all of the species *colubriformis*; four parasitic females of *Strongyloides papillosus* were also recovered from the small intestine. Kid D yielded, at autopsy, in the abomasum nine female *Trichostrongylus* and four male *Trichostrongylus extenuatus*; in the small intestine about 700 female *Trichostrongylus* and 649 male *Trichostrongylus colubriformis*; also 17 *Strongyloides papillosus*. One *Trichuris ovis* was also found.

Reinfection of the kids by larvæ from their own fæces did not occur, owing to the dry state of the yards, except in the case of Kid A, which was purposely fed with such larvæ; the ground was proved to be non-infective to clean kids.

From these experiments it would appear probable that the human infestations consisted of *Trichostrongylus colubriformis, Trichostrongylus extenuatus* and *Hæmonchus contortus*.

That some of the ova present in the human fæces (and probably the great majority of them) were

those of *Trichostrongylus colubriformis* was proved beyond doubt; but although great pains were taken with the management of the goats, it was judged that all possibility of naturally acquired infection could not be entirely excluded; this, it was considered, introduced a very slight doubt concerning the light infestations with *Trichostrongylus extenuatus* found in three out of the four kids and a somewhat greater one concerning the infestation of Kid A with *Hæmonchus contortus*.

These uncertainties, however, are small, since none of the controls became infected, although they were kept in the same yards as the infected kids until about the time when these were expected to begin passing ova; dividing fences were then erected across the yards.

The *Hæmonchus contortus*, if derived from man, may have come either from one or more of the N. family or from some of the Mareeba cases. The third stage larvæ of *Hæmonchus contortus* can be distinguished easily from those of species of the genus *Trichostrongylus*. None was seen among those larvæ from the cultures of the human fæces which were examined microscopically; their presence, however, was not then suspected or a more extensive search would have been made.

The Incidence of Trichostrongyles in Man.

These three worms have all been found in man before, though not in Australia. They are widely distributed in some of the domestic animals, which are their normal hosts.

The genus *Trichostrongylus* contains one species, *Trichostrongylus orientalis* Jimbo, which was first found in man and of which he has been supposed to be the proper host. It is common in Japanese peasants and in some other Far Eastern countries, and has recently been found in Armenians by Kalantarjan.[1] Faust, however, has found it in fat-tailed sheep and Bactrian camels in North China[2] and it has recently been reported from the porcupine.[3] The number of the worms in man is usually small and it seems still uncertain whether or not he is the optimum host.

Trichostrongylus colubriformis was found by Looss in the small intestine of Egyptian fellahs, as well as two other species, *Trichostrongylus probolurus* (Railliet) and *Trichostrongylus vitrinus* Looss. The usual hosts of these three worms are sheep, camels and goats. *Trichostrongylus colubriformis* was also found in man in India by Clayton Lane,[4] and both this worm and *Trichostrongylus probolurus* in Armenia by Kalantarjan.

The first and only previous record of *Trichostrongylus extenuatus* from man is also that of Kalantarjan in Armenia.[1] This worm is a parasite of sheep, goats and cattle, and apparently also of the horse, since it is stated that *Trichostrongylus extenuatus* (Railliet) is a synonym of *Trichostrongylus axei* (Cobbold); the latter name has priority, but has not been adopted in this paper.

Probably some of these worms, such as *Trichostrongylus colubriformis*, are widely distributed as occasional parasites of man where he is surrounded by heavily infested animals.

Eggs resembling those of *Trichostrongylus* have been found occasionally in human fæces in several parts of the world during hookworm surveys. The species producing them has often not been determined. Chandler,[5] for instance, found such eggs to be widely, but not evenly, distributed in India; in certain districts 10% or even more of the population harboured them.

As regards *Hæmonchus contortus*, a case in Brazil is, so far as the writers are aware, the only incontestable instance in which this worm has hitherto been found in man.

Sweet[6] mentions the finding of ova of *Hæmonchus contortus* in the fæces of three aborigines in Western Australia and this record in an unqualified form has found its way into the literature. In his original report, however, Dr. A. H. Baldwin, who found these ova, was careful to point out that the stools were collected from the ground and probably contaminated with the fæces of sheep; and this probability is duly mentioned by Sweet.

In the Brazilian case the worms were found by de Magalhaes in a patient suffering from severe anæmia, thought to be due to hookworms. The administration of thymol, however, expelled no hookworms, but a large number of *Hæmonchus contortus*; the patient improved rapidly. *Hæmonchus contortus* is a well known and widely distributed parasite of sheep; it also occurs in cattle.

Endemiology in Man in Australia.

There is no reason to suppose that human trichostrongyle infestation in Australia is confined to the districts where hookworm is endemic. It probably extends into cooler regions, but not into the very dry areas of the interior where the worms are scarce or absent, even in sheep and goats. That North Queensland forms the main field of operation for hookworm surveys sufficiently explains the fact that most of the cases of trichostrongyliasis have been found there.

During the 1928 hookworm surveys of two very different districts, the Atherton Tableland and the coastal area embracing Babinda and Gordonvale, special attention was directed to these infections.

Examination of fæcal specimens by the Willis method from 6,983 out of about 10,000 inhabitants of the Atherton Tableland revealed ova resembling those of *Trichostrongylus* in 24 persons, an infection rate of between 0·3% and 0·4% for the whole area.

In the town of Atherton two cases only were found, both in new arrivals, one from Greece and the other from the coastal belt. The other twenty-two cases all fell in one or other of two small areas of the tableland. The country round Yungaburra, Lake Eacham and Lake Barrine yielded nine infected persons in 2,114 examinations, and the town of Mareeba 13 in 1,186. The conditions in these two districts are different.

The Yungaburra district is elevated, hilly country with moist, red soil; its average height above sea

level is about 2,500 feet; the usual annual rainfall varies from about 70 to 90 inches. Sheep were raised on the properties on which all the infected persons in the Yungaburra district resided, and it was only on these properties that sheep farming is attempted extensively in the district. Sheep droppings taken at random from three of these four properties always contained ova resembling those of *Trichostrongylus*; from a specimen from a sheep on the farm of the N. family, sent to Townsville, larvæ of this genus were cultured in large numbers. It appears, moreover, that strongyle infestations are a serious hindrance to sheep raising on the Atherton Tableland.

In the Mareeba area the cases were all found in the town of Mareeba, which is 1,300 feet above sea level, has dry, sandy soil and a much drier and warmer climate than the Yungaburra district; the average rainfall is about 35 inches. Here there are no sheep, but goats are numerous all over the town. In one street, where in particular they flourished exceedingly, five of the thirteen cases were found. Samples of goat droppings yielded ova resembling those of *Trichostrongylus* and from a cultured specimen larvæ of this genus and also those of *Hæmonchus contortus* were obtained. All the cases in Mareeba had some association with goats.

As regards age incidence, 17 of the 24 infested persons were under seventeen years of age; most of these commonly went barefoot. Four of the children were under six years of age, the youngest three and a half. There were several adults near middle life affected. Though the age distribution in these few cases might suggest a mode of infection similar to that of hookworm, which in Australia falls heaviest on the school child, barefoot age, the inference would not be warranted in view of the known facts concerning the larvæ of these worms.

As regards family incidence, all the infected persons at Mareeba, except two, belonged to different families. In the Yungaburra district there were four infected children in the N. family, the parents escaping; three in another family, two parents and one child; one in each of the other two families. The family incidence in this district is doubtless due to their members living together on sheep farms.

In the Babinda-Gordonvale district only three cases were found in 5,263 Willis examinations from a population of about 7,000. To these should be added one of the patients found in the town of Atherton, a nine year old girl, who had previously lived near Babinda. Of these four patients, however, two, mother and daughter aged six, had recently arrived from Charters Towers, where there was a history of association with goats. The fourth patient was a Syrian adult, long resident near Babinda. So that two infections only were probably acquired in the district, a rate of about 0·04%. The neighbourhood of Babinda is a very wet portion of the hot, humid coastal belt. Sugar growing is the main industry and sheep are not raised. There

are some goats, but they are nowhere so numerous as in the town of Mareeba.

No relation was found between infestation with trichostrongyles and with worms proper to man; hookworm ova were not found in any of the cases.

Life History of Trichostrongyles.

The life histories of *Trichostrongylus colubriformis* and of some other members of the genus are well known and so is that of *Hæmonchus contortus*. Monnig,[7] for instance, has given a detailed account of the development of *Trichostrongylus colubriformis* while in the case of *Hæmonchus contortus*, owing to the work of Ransom, and especially of Veglia,[8] the life history and the biology of the free living stages are perhaps as completely known as for any strongyle, not excepting the human hookworms.

In general, the life histories and extracorporeal stages of these worms are similar and resemble broadly those of hookworms. The larvæ, however, develop a little more rapidly, thrive at lower temperatures, possess a considerable power of withstanding dryness, are not thermotropic, and infect only by the alimentary route.

When the larvæ reach the infective third stage, they ascend prominent objects, such as blades of grass, if the conditions are favourable; under other conditions they may retire into the earth. They are able to travel only in the presence of moisture; when overtaken by dryness they coil themselves up like watch springs and become quiescent. In this condition they can survive for a considerable period, though not for as long as in water or moist earth.

Of a few third stage larvæ of *Trichostrongylus colubriformis* spread out in clean water on a glass slide, allowed to dry and kept in a dark cupboard during the Townsville winter, three-quarters were found to revive when wetted fifty-two days later; they were then feeble and sluggish, but lived in water for many days. Similarly dried on a slide, which was then sealed in a tube and kept in a cold room at a temperature varying between 1° and 6° C., many of these larvæ revived after 116 days. In earth or coiled in masses on herbage they can survive for still longer periods in the dry state.

Their resistance to heat is much greater when dry than in the presence of water; some larvæ of *Trichostrongylus colubriformis* were found to survive twelve hours' exposure to a temperature of 52° C. when dried on filter paper.

The resistance of these larvæ to sunlight, especially if direct and unfiltered through green vegetation, is limited, though greater than that of hookworm larvæ. In the Townsville winter two and a half hours of bright sunlight was found sufficient to kill third stage larvæ of *Trichostrongylus colubriformis*, whether in water or dry; the temperature was not allowed to rise above 34° C.; in water maintained below 20° C. they were dead after five hours' exposure. The sheaths or cuticula of these larvæ and of hookworm larvæ appear, nevertheless, to be opaque to much of the ultra-violet spectrum, since

the interposition of thick sheets of crown glass makes no very great difference in the survival time. The third stage larvæ of *Hæmonchus contortus* are less resistant to dryness and somewhat less to sunlight than those of *Trichostrongylus colubriformis*.

Animals are infected by the ingestion of larvæ with grass and other herbage, an end which these adaptations of the larvæ subserve.

That neither the larvæ of *Hæmonchus contortus* nor those of several of the more fully investigated species of *Trichostrongylus* are capable of infestation by skin penetration has been abundantly proved. According to Kitamura,[9] however, the larvæ of *Trichostrongylus orientalis* are able to infect through the skin. Koino,[10] however, states as the result of his more recent experiments that it may safely be concluded that the most common and normal way of infestation is by the mouth.

A number of experiments made with larvæ of *Trichostrongylus colubriformis* from Townsville goats proved that they are not skin penetrators. Some of these consisted in unsuccessful attempts, using the method of Goodey,[11] to get them to penetrate the skin of young rats floated on warm saline solution. Large numbers of vigorous third stage larvæ were also on two occasions placed under moist bandages on thin parts of the skin of the human leg and foot. No irritation or local lesions whatever resulted and no ova appeared at any time in the fæces.

The period required for these worms to reach maturity in man is not known, but it is likely to be at least as long as that required in their optimum hosts. Monnig[7] states that the normal interval between the drenching of lambs with third stage larvæ of *Trichostrongylus colubriformis* and the appearance of ova in their fæces is twenty-five days. In Kid B, in which only *Trichostrongylus colubriformis* was found, daily cultures from large fæcal specimens were made and the specimen passed twenty days after the first infective feed was the first to yield a few larvæ; by centrifugal flotation no eggs could be detected until the twenty-first day. Veglia[8] found that ova might appear in the fæces on the fifteenth day after administration of *Hæmonchus contortus* larvæ to sheep.

The longevity of the worms in man is unknown. So is the proportion of larvæ ingested which succeed in reaching maturity in this abnormal host. There is no evidence at present that children are more suitable hosts than adults.

Manner of Infection of Man.

The known facts seem to lead to the conclusion that infection of man, as of animals, must be by swallowing the larvæ and to negative the supposition of penetration through the skin.

The precise circumstances under which ingestion of the larvæ most commonly takes place remains conjectural. Transference of infective larvæ to the mouth from the hands or on contaminated food cannot be excluded as a possibility. The water supply of two at least of the infected families on sheep farms on the Atherton Tableland consisted of iron rainwater tanks filled from the roof, and direct pollution of these was impossible. There seems a possibility, however, perhaps rather remote, that grass or leaves to which dried larvæ were adherent, might be blown on to the roof and thence washed into the tank. Even the detached larvæ might thus be carried short distances by the wind. The felted, fawn coloured masses of dry, coiled-up larvæ which are sometimes found on objects projecting from a rich culture, are readily detached and broken up by a light touch. Such agencies as the feet of men and animals must sometimes rub them off and the larvæ might then be blown on to food or water supplies or even swallowed as dust.

But perhaps the most plausible supposition is that infection usually results from the habit which many people, especially children, have of sucking and chewing pieces of grass. Infection of man would then result from his occasional indulgence, like Nebuchadnezzar, in the diet of ruminants. This habit was noticed in one of the infected children of the N. family.

Diagnosis.

Infection of man with worms of the genus *Trichostrongylus* may be recognized, or rather suspected, by finding the eggs in the fæces by any of the methods of examination used for hookworm eggs. A surer method is the examination of third stage larvæ obtained by culture. In structure the eggs are like those of hookworms and other strongyles, but, though only a little wider than hookworm eggs, they are much longer. The differences in shape between the anterior and posterior ends and the dorsal and ventral sides which are generally present in strongyle eggs, are more pronounced in those of the genus *Trichostrongylus* than in the eggs of hookworms.

The measurements of strongyle eggs are of importance, since they often constitute the only recognizable difference between those of different worms. Monnig[7] gives for the length and breadth in microns of the eggs of *Trichostrongylus colubriformis* 75 to 80 by 40 to 43; the average length given by Looss[12] is slightly less. These measurements were from eggs in the uteri of preserved worms. They are certainly too small for the eggs found in the fæces.

Forty-one eggs of *Trichostrongylus colubriformis* in the fæces of goat B were found to range from 82 to 96 by 40 to 47·5; the mean was 87·5 by 43·8, which agreed well with the mean measurements of some eggs in the fæces of the N. family. Another difference between the eggs of *Trichostrongylus* and those of the hookworms is their more advanced state of division in fresh fæces. The eggs of *Trichostrongylus colubriformis* are in the 24 to 32 celled stage in the fresh droppings of sheep (Monnig).

The eggs of *Hæmonchus contortus* often differ less obviously from hookworm eggs than do those of the genus *Trichostrongylus*. Both are more advanced in division in fresh fæces than hookworm eggs, but in hookworm surveys the specimens are often not

fresh and size and shape have to be relied on. In shape *Hæmonchus contortus* eggs often resemble hookworm eggs. As regards size, Vegiia[8] gives as mean measurements 70·9 by 45·9 and states that a common minimum size is 66·5 by 43·3 and a frequent maximum 79 by 46·6. The mean measurements of twenty-six eggs from the abomasa of a sheep and a goat in Townsville were 70·7 by 42. The latter measurements are close to those not uncommonly found in eggs of *Necator americanus*, while the figures given by Veglia as common minimal ones could easily be matched with eggs of either *Necator americanus* or *Ancylostoma duodenale*.

These facts and experience of the general appearance of the eggs and of the work of hookworm surveys strongly suggest that eggs of *Hæmonchus contortus*, if they have been met with in human fæces, must often have been mistaken for those of hookworms. It is not impossible that *Hæmonchus contortus* may be a less rare infection in man than is supposed. Brumpt[13] remarks that the worm, though common in stock throughout the world, has not once been reported in man by the numerous hookworm surveys which have had the opportunity to examine great numbers of worms. Too much weight need not be attached to this argument, since the percentage of the population from whom, during most hookworm surveys, worms have been examined, has been exceedingly small.

Pathogenesis.

No symptoms clearly referable to infestation with *Trichostrongylus colubriformis* seem to have been noted in man. The North Queensland patients were generally healthy. It is likely that if large numbers of the worms were present, anæmia of the usual strongyle type would appear, but in man it is evident that there are usually but few. Looss,[12] in his autopsies on natives of Egypt, found only small numbers of the worms, never more than 30 or 40; the duodenum was their site. Egg counts were not made in any of the North Queensland cases, but the eggs were never very numerous. This worm is a cause of severe disease with anæmia in lambs, when present in large numbers.

Hæmonchus contortus in the only previously recorded case was present in numbers and caused a condition mistaken for ankylostomiasis. In lambs it is a well known cause of serious disease.

Treatment.

Hæmonchus contortus in the single recorded case in man was expelled by thymol. For *Trichostrongylus orientalis* carbon tetrachloride is said to be effective.

The experience in the Australian infections, which have probably been infestations mainly with *Trichostrongylus colubriformis*, has been as follows. In the final report of the Hookworm Campaign, 1924, it is stated that the adult worms were never recovered, in spite of repeated efforts with various drugs. Dr. H. R. Pearson in a report of a hook-

worm survey of the Cairns district in 1925 stated that one child infected with *Trichostrongylus* and hookworms was cured of the hookworms after two treatments, but still harboured the trichostrongyles. The drug used in this instance was probably carbon tetrachloride. Three of the boys of the N. family were treated with oil of chenopodium, 0·18 mil (three minims) per year of age, divided into three doses at hourly intervals. The eldest, aged fifteen, was cured with one treatment, the next, aged ten, with two, and the third, aged eight, with three. Cure here means that Willis examinations revealed no ova two weeks after treatment.

II.—STRONGYLOIDES STERCORALIS IN QUEENSLAND.

Strongyloides stercoralis Bavay has a wide distribution and is not so limited as are the hookworms of man to warm climates. But its incidence in civilized communities is usually low.

The Australian Hookworm Campaign[6] found 373 cases in 167,290 examinations in Queensland, a rate of 0·22%. The examinations were generally made by the Willis method and were not especially directed to the discovery of parasites other than hookworms.

But a good deal of uncertainty probably attaches to these figures for *Strongyloides stercoralis* owing to the possibility of confusion with free-living coprophilic worms; specimens are often several days old at the time of examination by hookworm microscopists.

Kobayashi in Japan[14] and Sandground[15] in the United States have suggested that many of the records of *Strongyloides stercoralis* in their respective countries and elsewhere were probably unreliable owing to the presence in the specimens of *Rhabditis hominis* Kobayashi. *Rhabditis hominis* is a free-living worm which can be propagated indefinitely in fæcal cultures and is probably widely distributed in the soil. According to Kobayashi it is also an occasional parasite of the human gut, but Sandground produces strong evidence against this; the question is still controversial.

These considerations led to special attention being given to the incidence of *Strongyloides stercoralis* in North Queensland during the 1928 and 1929 hookworm surveys. No specimen was diagnosed as *Strongyloides* in which the characteristic infective larvæ were not seen and examined in detail. Adult worms of the free-living generation were also obtained from four of the specimens, the only ones which could be adequately examined before they were too old.

In addition, during the first of these surveys, that of the Atherton Tableland in 1928, portions of all specimens in which larvæ or adult worms of any description were detected, were sent to the Australian Institute of Tropical Medicine at Townsville and there examined in detail before and after subculture.

During the earlier part of these surveys direct smears in water were examined from as many speci-

mens as possible in addition to the routine salt flotation for hookworm ova by the Willis technique. But, as it was found that worms of any kind were very seldom seen in direct smears which were not also detected by the Willis method, the latter was later used exclusively, of course, supplemented by other methods when worms or their larvæ were found.

The fæcal specimens examined in these surveys were placed by the persons concerned in the small tins provided, of a capacity of about eight cubic centimetres. At the time of their examination they were most commonly one week old.

The table shows the results of these and other surveys. Those of 1929 were carried out by Dr. T. R. Pearce.

Considering first the few aborigines examined, it will be noted that among the 368 living at the Yarrabah Mission Station a comparatively high rate of infection was found, about 1·3%. In the 400 or so other aborigines living scattered or in camps throughout the districts surveyed one case was found. The total aboriginal rate is therefore about 0·8%.

On the other hand, only seven cases were found among about 23,000 other persons examined, the great majority of them whites, of either north or south European descent. This is a rate of 0·03%.

The rate for all races is about 0·059% and is only about a quarter of the rate for all races found in Queensland by the Australian Hookworm Campaign.

In the Atherton Tableland survey, as shown in the table, no *Strongyloides* were found in whites, but free-living worms were present in 22 specimens; eighteen of these contained coprophilic worms multiplying abundantly in fæcal cultures and bearing a general resemblance in the adult stage to the free-living adults of *Strongyloides*, and in the larval to the young larvæ of the same worm. If these eighteen specimens had been recorded as *Strongyloides stercoralis*, the rate for the district would have appeared as 0·26%.

Of the seven whites in whom infestation with *Strongyolides stercoralis* was detected, six were children aged from two to fifteen years; most of them were born in Australia, five of Italian parents, one of Greek. In one family the infestation was found in the three children, but was not detected in the parents; the other three children belonged to three different families of whom no other members were found to be infected with *Strongyloides stercoralis*. Most, if not all, of these children went barefoot. The seventh patient was a man in middle life, of north European descent, employed in the removal of sanitary pans; he was in addition infested with *Ancylostoma duodenale* and the other members of his family also harboured this worm.

Of the six aboriginal patients four were children, aged five to ten years, one a man of thirty-four, one a girl of nineteen; all were unshod. *Trichuris trichiura* was present in four of these cases and in one of them hookworms as well. The six patients lived in different houses.

It is very necessary to remark, however, that all the figures here discussed for the incidence of *Strongyloides* (except the few from the Townsville Orphanage), as well as most of those published for other parts of the world, are derived merely from the results of direct microscopical examination of the fæces. It has been emphasized by Sandground that many infestations are too scanty to be detected by such direct examination, though revealed by culture followed by Baermann isolation. This entirely accords with the experience of the writers with both man and animals. The true incidence of this infestation in Queensland and most other countries is therefore still unknown. In several of our North Queensland cases the infestation seemed to disappear as judged by direct examination, and this both after treatment and in its absence.

Coprophilic Worms.

As already stated, worms other than hookworm larvæ or *Strongyloides* were found in 22 out of 6,983 specimens in the Atherton Tableland. Reexam-

Survey.	Number Examined.	Method of Examination.	Number of Cases of *Strongyloides stercoralis*.	Number of Specimens containing Free-living Worms.
Atherton Tableland; general population, 1928	6,983	Willis; direct smear as well from 2,296 specimens.	1 (aboriginal)	22
Babinda–Gordonvale District; general population, 1928	5,263	Willis; direct smear as well from 234 specimens.	2	Not recorded.
Ingham District; general population, 1929	7,684	Willis	5	Not recorded.
Cairns; school children, 1929	About 1,700	Willis	0	Not recorded.
Part of Innisfall–Tully District; chiefly school children, 1929	1,841	Willis	0	Not recorded.
State Orphanage, Townsville; white children, 1928	22	Culture	0	None
Aborigines in the districts named above	About 400	Willis	1	Not recorded.
Aborigines at Yarrabah Mission Station, near Cairns, 1928	368	Willis	5	Not recorded.
Total, excluding aborigines	About 23,000	—	7	

ination and subculture at Townsville revealed nothing in two of these and in two others scanty worms belonging to free-living or plant parasitic species which did not multiply in fæcal cultures.

The remaining 18 specimens contained coprophilic worms which were propagated in subcultures and examined in detail. They were found to consist of at least five well differentiated species, four of which were referred to the genus *Rhabditis* and one to the genus *Cephalobus*; the generic criteria used were those given by Baylis and Daubney.[16] At present the classification of free-living nematodes is in a rudimentary stage and their precise identification is often very difficult.

One of the species of *Rhabditis* found in four of the specimens was close to *Rhabditis hominis* Kobayashi, though probably not the same species, unless it is a variable one. The length of the adult worms (female 0·8 millimetre, male 0·52 millimetre) was only about half that given by Kobayashi; this, however, may possibly have been due merely to the use of a poor culture medium; the reduction in length of the œsophagus (which measured 0·145 millimetre in an adult female) was much less than in the total length, as is usual in stunted specimens of such worms.

Apart from size the worms agreed fairly well with Sandground's drawings and descriptions of *Rhabditis hominis*, with the exception of the posterior extremity of the male. While the form of this and of the bursa and its supporting papillæ resembled in general the drawings of Sandground, there appeared to be seven pairs of bursal papillæ instead of six, though it could not be ascertained with certainty whether the papillæ of the extra pair (the fourth) were actually in the bursal alæ or situated more laterally just outside them. This fourth pair of papillæ is postanal; the third pair (as in Kobayashi's worm) is about on a level with the anal aperture, sometimes appearing a little in front of it, sometimes behind it. Apart from the bursal papillæ there were two other pairs of caudal papillæ outside the bursa not described in *Rhabditis hominis*; these were on the lateral aspects of the posterior extremity just anterior to the point of abrupt tapering off to form the terminal portion of the tail. The posterior of the two median ventral papillæ described by Sandground was present (the anterior one was not searched for). These features are shown in the drawing.

50 μ
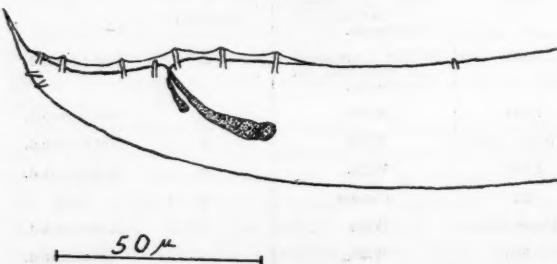
Posterior extremity of male *Rhabditis* sp. (close to *R. hominis* Kobayashi).

Another minor difference between these males and Kobayashi's description of the male *Rhabditis hominis* is that the testis, instead of being straight, is reflexed a short distance behind the termination of the œsophagus and runs back to end near the middle of the body.

Rhabditis hominis is described as viviparous; the worm just described is also in the main viviparous, but eggs are also laid by the younger females; salt flotation on a culture will reveal some eggs with larger numbers of larvæ. The eggs, when laid, measure about 42 to 48 microns in length by 25 to 32 in width. One of the other species of *Rhabditis* found in five of the specimens was oviparous to a much greater extent; the eggs were seen in all stages, from the eight celled to that containing a fully formed larva.

All these species of worms were found in stale specimens which may have been contaminated by careless collection; gross contamination with earth was present in one of them. Sandground has suggested that flies may possibly introduce *Rhabditis hominis* into fæces. It was noticed that the coprophilic worms were more prevalent in the earlier months of the survey when the weather was hotter.

The presence of rhabditids may give rise to errors in diagnosis in several ways.

Their eggs in a Willis preparation have been mistaken for hookworm eggs, though they are in general smaller and much narrower, and have thinner shells and a more transparent appearance. They are much more like the eggs of *Strongyloides stercoralis*, which are sometimes found in fæces as well as hatched larvæ.

The adult rhabditids are often confused with the free living adults of *Strongyloides* and careful examination is sometimes required to distinguish them. It is useful to remember as a diagnostic feature not requiring exact acquaintance with the anatomy of these worms, that if transverse cuticular striæ can be detected readily in adult rhabditiform worms, they are not *Strongyloides*.

Finally, the larvæ of these rhabditids require to be distinguished from the young rhabditiform larvæ of both hookworms and *Strongyloides stercoralis*. Although distinguishing features exist, it is much more satisfactory to culture the specimen for a few days and then isolate the worms with a Baermann apparatus.

III.—NOTES ON SOME HELMINTHOLOGICAL METHODS.
The Use of Larval Cultures.

In general, culture and isolation of infective larvæ in infestations with nematodes having free-living larvæ is a much more delicate method of detecting scanty ova in the fæces than any of the methods of concentrating and searching for the ova themselves.

This is especially true of the fæces of herbivorous animals in which the particles of plant fibre introduce a troublesome complication into flotation methods for concentration of ova, and in which the fæcal material in its natural state, owing to its

composition and open texture, sometimes provides a suitable culture medium with little treatment except the provision of moisture.

In the fæces of man and carnivorous animals, on the other hand, only those strongyle eggs which happen to lie near the surface are able to develop until the mass is broken up by the weather or the operations of insects or by artificial means. Nevertheless, from fresh human fæces, if properly treated, it is easy to culture and isolate third stage hookworm larvæ exceeding in numbers three-quarters of the eggs present in the sample.

It is therefore not surprising that our experience has shown that a properly made culture from fresh human fæces, especially if twenty grammes or upwards are available, is a far surer method of detecting scanty strongyle infestation than even the well known and excellent centrifugal flotation technique of Clayton Lane. His technique, it is true, will detect one female hookworm, if ovipositing normally, but this condition is not always fulfilled, and Chandler[17] states that hookworm ova may be as scarce as one per gramme of fæces. Though the Clayton Lane method is of ample delicacy for ordinary diagnostic work, culture is preferable as a more rigorous proof of complete cure after treatment and often in experimental work. In animals such as sheep, goats, rabbits and horses the superiority of larval culture to concentration of ova is far more pronounced than in man.

Culture methods have, of course, the further advantage that when the species of worm is in doubt information can often be obtained by examination of the third stage larvæ; examples are the two species of hookworms in man and the various genera of strongyles in stock.

The method of culture recommended for human fæces and those of carnivora was described in a previous paper[18] and is here amplified. The sample is rubbed up with water and the emulsion poured into a tall vessel; a large amount of water should be used. When sedimentation has taken place, the supernatant fluid is poured off and the sediment poured on to the surface of a quantity of dry earth contained in a tin; the earth must have been well shaken down in the tin and should be more than sufficient to absorb the fluid poured on. After a short time the fluid will soak in; the greater part of the sediment containing the eggs is filtered out and remains on the surface. The surface is then loosened and broken into fragments by means of a splinter of wood. Such a culture is free from excess of moisture and from smell and all the ova are well supplied with oxygen.

The result obtained appears to resemble somewhat that described by Chandler[5] as resulting in nature from the operations of beetles which intimately mix the stools with earth and form a finely divided loose mass which, he says, forms a perfect culture.

After some days, five or six for hookworm cultures in warm weather, the top inch or so is scraped off and placed in a second tin, of which the bottom has been replaced by a piece of stretched calico on which clean sand is spread to a depth of two or three millimetres. The tin is placed in a Baermann funnel and the larvæ drawn off in the usual way. Immature larvæ will be found to be absent and those drawn off within the first few hours are obtained in perfectly clean water.

The hookworm larvæ, which in a culture such as has been described, climb the sides of the tin, are but a small minority; the great majority are removed with the surface layers of the earth and on its projecting particles.

These methods are here described because experience has proved their convenience and that they give a much better yield than most of the various methods which are favoured in different parts of the world.

Not the least of the advantages of the sedimentation from excess of water appears to be the dilution of substances inimical to the development of the larvæ. Such substances appear to be present quite often in the fæces of civilized man; one of the most obvious is magnesium sulphate.

The work of McCoy[19] on the culture of hookworm larvæ from sterilized eggs with a pure culture of a single bacterium has provided a most valuable method in which the environmental conditions can be made constant. It is not, however, simple enough for routine diagnostic work.

Orientation of Thermotropic Larvæ.

For the detailed examination of the anatomy of nematode larvæ, an end-on view, that is, one of the anterior extremity from directly in front, is sometimes very desirable. It is very difficult to obtain by ordinary methods, and an elaborate technique has been described for the purpose in the case of hookworm larvæ.[20] But for these and other thermotropic larvæ the following simple method will be found very effective.

The larvæ are placed on a slide in a small drop of water and a large drop of thick agar at a temperature below 45° C. is allowed to fall on them; a cover glass is applied immediately. When the agar has set, a hot glass rod is brought close to the upper surface of the cover glass; many of the larvæ will be seen to congregate at a point immediately beneath the rod, trying to bore through the cover glass; the hot rod is then lowered into light contact with the coverglass for an instant and then removed.

If the preparation is then placed under the microscope, a number of the larvæ are found to have been killed in such a position that a good end-on view is obtained; they are held in this position by the agar. As the anterior extremities are immediately beneath the cover glass, oil immersion lenses of short working distance may be used.

SUMMARY.

1. It is shown that *Trichostrongylus colubriformis* is an occasional parasite of man in Australia. So

probably are *Trichostrongylus extenuatus* and *Hæmonchus contortus.*

2. These infestations are found in persons associated with sheep and goats and are acquired by swallowing the larvæ derived from their droppings.

3. A survey of parts of North Queensland for *Strongyloides stercoralis* by direct fæcal examination revealed an infection rate in whites of only 0·03%. The rate found for all races was about a quarter of that previously recorded.

4. The coprophilic worms which were found in stale fæcal specimens and which were probably the main cause of this discrepancy, are recorded, with especial reference to *Rhabditis hominis*, Kobayashi.

5. An improved method of fæcal culture for larvæ and a method for the orientation of thermotropic larvæ are described.

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ON THE APPARENT DIMINUTION IN SKELETAL MUSCLE TONUS FOLLOWING REMOVAL OF THE LUMBAR SYMPATHETIC TRUNK.

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DURING the past twelve months a series of experiments has been carried out in the Department of Anatomy of the University of Sydney under the A. Liston Wilson Foundation in an attempt to further the observations made by Dr. N. D. Royle[1] and Professor J. I. Hunter[2] on the changes in posture and postural reflex actions following the removal of the sympathetic innervation to a limb.

In this article the results of this work are presented more or less summarily and are discussed chiefly in regard to their significance in relation to the explanation of the apparent diminution in skeletal muscle tonus following removal of the postganglionic fibres of the sympathetic nervous system.

A complete account of the technique and results of these experiments has been presented for publication elsewhere.

Physiology of Muscle Tonus.

Galen (A.D. 131-201) recognized that the extremities could be maintained in characteristic positions in relation to the trunk without that same degree of fatigue which inevitably accompanies continuous voluntary contraction of skeletal muscle. He realized that this postural activity was dependent upon some function of skeletal muscle; to this function he applied the term "tonus" in the sense of "active posture."

He did not discover that this active posture was a reflex phenomenon, although he observed that it disappeared in skeletal muscles on the section of their motor nerves.

In 1838 Muller[3] departed from this original conception of tonus and regarded it as a slight contractile tension of muscle produced by the continual influence of cerebral nerve centres.

Brondgeest,[4] in 1860, attributed the production of tonus to a tonic reflex arc after demonstrating that it was diminished in frogs by severing the appropriate posterior nerve roots. Further work on this problem in the later years of the last century produced many new theories to explain tonus.

It was regarded by various observers as an inherent property of skeletal muscle, as tension produced by automatic central stimulation, as a function of the red fibres of skeletal muscle, as some contractile function of muscle sarcoplasm and as a non-contractile fixation mechanism in various elements of skeletal muscle.

This diversity of opinion led to a marked degree of confusion of the meaning of the term tonus, and not until the work of Sherrington[5] on spinal and decerebrate cats was it recognized that posture was produced by an all-or-none contraction of muscle fibres and that the tonus thus produced was dependent upon the functional activity of the proprioceptive reflex arcs situated in skeletal muscles subserving posture. Sherrington demonstrated that the tonus or postural contraction disappeared either on section of the motor nerve or on section of the appropriate posterior nerve roots.

Certain postural reflex actions were described by Sherrington which conferred a quality of plasticity on the postural muscles and were named the lengthening and shortening reactions.

These reactions also were shown to be dependent upon the integrity of the proprioceptive reflex arcs of these skeletal muscles subserving posture.

Later work by Liddell and Sherrington[6] on the behaviour of skeletal muscle in response to stretch has shown that when a muscle is subjected to a gradually increasing stretching force, it responds very early by a reflex contraction; this contraction is graded and within limits increases as the stretching force is increased.

This reflex was named the myotatic or stretch reflex and was shown to be dependent upon a proprioceptive reflex mechanism.

Where the stretching force is increased beyond certain limits, the proprioceptive nerve endings subserving the lengthening reaction are stimulated and the muscle lengthens reflexly (see Figure I).
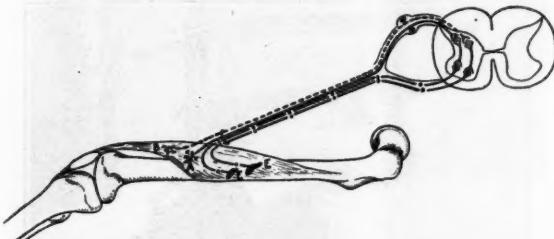

FIGURE I.

Diagrammatic representation of the proprioceptive reflex arcs subserving the myotatic or stretch reflex and the lengthening reaction in the *vasti femoris* muscles. "A" = receptor endings for the myotatic reflex. "B" = receptor endings for the lengthening reaction. "E" = effector nerve endings. An initial stretch gradually increasing first stimulates nerve endings "A" producing a postural contraction. At a certain degree of stretch the threshold of stimulation for the endings "B" is reached and the muscle lengthens reflexly.

The work of Fulton and Liddell,[7] published in 1925, on the electrical responses of skeletal muscles during postural (myotatic) contraction, has produced evidence that the stretch reflex is based upon a complete asynchronism of afferent stimuli arising in the postural muscle, indicating that the postural contraction is maintained by the rotational activity of individual muscle fibre units within the tonic muscle.

This successive activity of different portions of the muscle provides a reasonable explanation for the persistent untiring nature of postural contraction.

Posture in skeletal muscle is maintained, therefore, by graded contraction in response to stretch, tonus in the muscle being the degree of this contraction produced by the stretching force.

The following problem has now arisen: "Do the post-ganglionic fibres of the sympathetic nervous system constitute the efferent limb of the reflex arc subserving tonus in skeletal muscle?"

This question has come into prominence chiefly as the result of the finding of non-medullated hypolemmal nerve endings in skeletal muscle and of the hypothesis that their situation designates them as being motor in function.

The evidence for and against the existence of these nerve endings is discussed in a recent paper by Professor Wilkinson.[8]

Hunter, accepting Langelaan's division of tonus into contractile and plastic elements, considered that Royle's observations on goats and his own on fowls proved conclusively that the efferent limb of the reflex arc subserving plastic tonus was constituted by post-ganglionic fibres of the sympathetic nervous system.

Professor Hunter[9] stated: "The experimental work and human operations of Dr. Royle have shown that the efferent limb of the reflex arc subserving plastic tone consists of the non-medullated post-ganglionic fibres of the sympathetic nervous system."

Since numerous criticisms have been levelled at the work of Dr. Royle and Professor Hunter, the following experiments were designed and carried out under physiological conditions in order to satisfy these objections.

Summary of Methods.

Fifteen cats were taken and divided into two groups, one of eight cats and one of seven.

In the seven group the left lumbar sympathetic trunk was removed from each animal and three weeks later decerebration was performed.

In the eight group the left lumbar sympathetic trunk was removed at the same time as the operation of decerebration was performed.

All the sympathetic trunks extirpated were photographed on removal.

In each animal the knee extensor (*vasto-crureus*) was the postural muscle selected for study.

The two knee extensor muscles in every cat were isolated from extraneous proprioceptive and exteroceptive reflex effects by section of all the cutaneous nerves to both hind limbs and tenotomy or motor

nerve section of all the muscles in both hind limbs with the exception of the *vasto-crurei* and that branch of the femoral nerve by which they are innervated.

Each animal was then placed on its back in a V-shaped wooden trough, and the head was flexed and strapped in the mid-line.

Holes were then drilled through the lower ends of the femora, a strong silver steel rod passed through them and clamped at each end in a heavy cast iron stand.
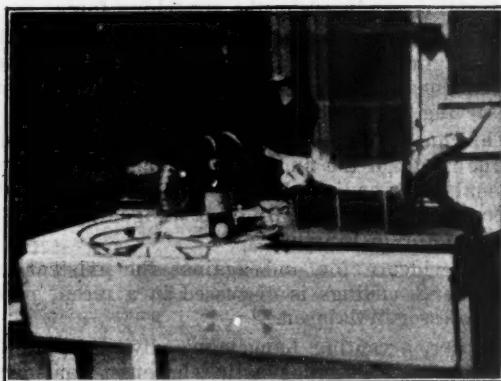

FIGURE II.

Decerebrate cat in fixed supine position on table (as described). Pulmonary ventilation is maintained by the apparatus seen to the left of the picture.

Adequate pulmonary ventilation was maintained from the moment of decerebration until the completion of all observations on the animal (see Figure II).

The brain stem of each animal was later removed and photographed. The posture and postural reflex actions were then examined and photographic and kymographic records made.

FIGURE III.

Extensor rigidity in both hind limbs of a decerebrate cat. Left lumbar sympathetic trunk removed immediately after decerebration. Photograph taken three hours after decerebration.

FIGURE IV.

Extensor rigidity in both hind limbs of a decerebrate cat. Left lumbar sympathetic trunk removed three weeks previously. Photograph taken three hours after decerebration.
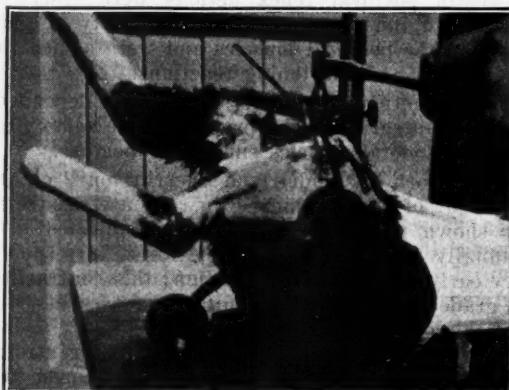
FIGURE V.

The left leg of the decerebrate cat shown in Figure III has here been passively flexed. The lengthening reaction has been elicited in the left *vasto-crureus* since the leg remains in a flexed posture. The left patellar tendon is about to be tapped with a percussion hammer.
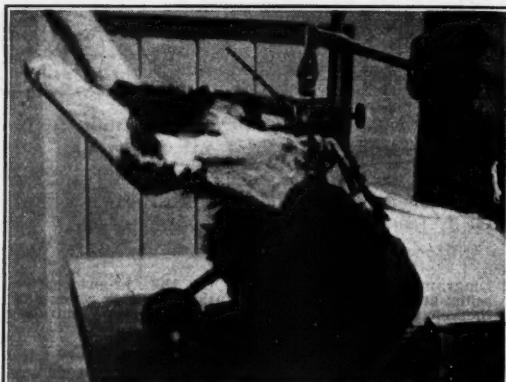
FIGURE VI.

Showing the posture adopted after tapping the patellar tendon once with the percussion hammer. A knee jerk has been elicited on the left side after which the left leg has come to rest in a more extended posture. The left *vasto-crureus* has shortened and is now exhibiting a postural contraction due to the activity of the stretch reflex.

These have been reproduced in the article referred to above. It is now proposed to summarize briefly the results of these experiments.

Summary of Results.

In decerebrate cats in which the left lumbar sympathetic trunk was removed either at the operation of decerebration or three weeks previously, the following occurrences are noted:

1. Extensor rigidity develops in both hind limbs and is maintained on both sides for at least three to five hours (see Figures III and IV).

2. Lengthening and shortening reactions are present in both hind limbs (see Figures V and VI).

3. The amplitude of the motor response of the crossed extensor reflex is greater on the right side than on the left for an equal or for a maximal degree of forcible passive extension of the appropriate tonic muscle.

4. The crossed extensor reflex may be elicited on the right side by a smaller stimulus (less stretch) than is required for its production on the left side.

5. The knee jerk on the left side is followed by a strong myotatic contraction which appears earlier during relaxation and is therefore produced by a smaller stimulus (less stretch) than the normal myotatic response on the right side (see Figure VII).
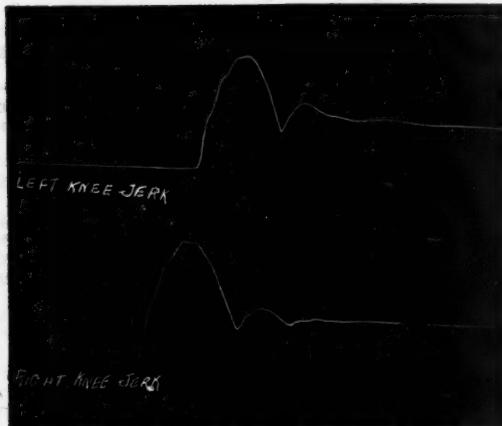
FIGURE VII.

Kymograms of knee jerks of a decerebrate cat. Decerebration and left lumbar sympathetic trunk removal performed two hours previously. Note that on the left side the myotatic reflex occurs earlier during relaxation and produces a higher level of the record than on the normal side.

6. With the animal placed in the fixed supine position, as described above, the only asymmetry of posture to be noted is a slightly more extended position of the knee joint on the left side.

7. The caudal end of the trunk can be supported at the normal standing height from the table by the right leg, but not by the left (see Figure VIII).

8. A passive flexing force which on the left side is sufficiently great to elicit the lengthening reaction, produces on the right side a myotatic contraction due to the stretch reflex. Further increase of this flexing force on the right side finally elicits the lengthening reaction.

FIGURE VIII.
Decerebrate cat supporting weight of caudal end of trunk on right hind leg. (Right lumbar sympathetic trunk intact.)

It is not proposed to discuss the first five of the preceding observations in any detail, but from them one may derive two facts, namely, that sympathetic nerves are not responsible for the maintenance of posture in skeletal muscle, since decerebrate rigidity develops and is maintained, and postural reflex activity is present in a muscle deprived of its sympathetic innervation, and secondly, that the excitability of proprioceptive reflex activity is increased

FIGURE IX.
Same decerebrate cat as shown in Figure VIII unable to support weight of caudal end of trunk on left hind leg. (Left lumbar sympathetic trunk removed three weeks previously.)

in a postural muscle after removal of the sympathetic nerves distributed to it. The following discussion is concerned chiefly with the diminution of tonus following sympathectomy noted by Dr. Royle and with observations number 6, 7 and 8 tabulated above.

Discussion.

After removal of the left lumbar sympathetic trunk in normal spinal and decerebrate goats Dr. Royle noted that resistance to a passive flexing force was diminished in the left hind limb.

This observation has been confirmed above (numbers 7 and 8). It has also been seen that a decerebrate animal may exhibit this apparent decrease in tonus and at the same time adopt a posture against the force of gravity.

This decreased resistance offered to passive stretch cannot be due, therefore, to the loss of any posture-producing mechanism.

It was pointed out above, in the discussion on the physiology of muscle tonus, that the resistance offered when a postural muscle is stretched is due to a contraction of muscle fibres produced by the myotatic reflex.

As the stretch is increased, so the contraction increases up to a certain degree of stretch, when the stretching force becomes sufficiently great to stimulate the proprioceptive nerve endings which elicit the lengthening reaction.

When this degree of stretch is arrived at, the muscle lengthens reflexly. The threshold of stimulation for the nerve endings of the lengthening reaction determines, therefore, the amount of stretch required to break down the resistance offered by the tonic muscle. If these nerve endings become more excitable, the myotatic reflex will be superseded earlier during the gradual application of a stretching force and the muscle will be lengthened by a smaller stretching force than was required under normal conditions of excitability.

It is suggested that this apparent diminution of tonus or decreased resistance to a passive stretching force following removal of the sympathetic innervation to a postural muscle is due to an increased excitability of the nerve endings, stimulation of which produces the lengthening reaction in the muscle.

If this increased excitability following sympathectomy be due to vascular disturbance, one would anticipate an increased excitability of all the proprioceptive endings situated in the muscle.

This can be seen to be the case. In the supine decerebrate cat the left hind limb following left lumbar sympathectomy has been seen to adopt a slightly more extended posture, due to the production of a postural contraction as the result of less stretch of the muscle than was required to produce a postural contraction on the normal side.

Similarly, the myotatic reflex following the phasic response of the knee jerk occurs earlier during relaxation if the sympathetic innervation is removed.

Again, the motor response of the crossed extensor reflex is increased in strength and amplitude following the removal of the sympathetic innervation to the contralateral postural muscle.

If this hypothesis be true, the stretch reflex will be produced in a sympathectomized muscle by less stretch than is required for its production in a normal muscle, and equal submaximal stretch applied to both muscles will produce a stronger myotatic contraction in the muscle deprived of its sympathetic innervation.

Further experiments will be directed towards the quantitative analysis of the stretch reflex in postural muscles before and after removal of their sympathetic innervation.

Conclusions.

The post-ganglionic fibres of the sympathetic nervous system do not constitute the efferent limb of the reflex arc subserving posture in skeletal muscle.

It is suggested that the apparent diminution in tonus in a postural muscle following removal of its sympathetic innervation is due to an increased excitability of the afferent nerve endings subserving the lengthening reaction.

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Reports of Cases.

ACUTE AMAUROSIS DURING PREGNANCY WITHOUT SIGNS OF TOXÆMIA.

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INCREASING blindness or dimness of vision is of grave import during pregnancy. It is usually a sign that the patient is becoming toxæmic, although she may not show the usual signs of toxæmia. This blindness often precedes the eclamptic convulsion in preeclamptic patients, but

usually it clears up rapidly after the uterus is emptied. It is supposed to be due to some poisoning of the ganglia and optic nerves by the toxin. Atrophy of the optic nerve may result and for this reason the pregnancy should be terminated as soon as possible.

In the case reported below the increasing blindness was the only sign of toxæmia. However, it was decided to terminate the pregnancy and the emptying of the uterus relieved the condition with really dramatic suddenness.

Mrs. M.N., aged twenty-eight, with two children, was first seen at the antenatal department of the Queen's Home on July 4, 1930. Her last period had finished on December 20, 1929, and she was about six months pregnant.

Her history was as follows. She had been born in Australia and the only previous illness was mumps. Her menstruation had started at nine and a half years and had been quite regular. She had been quite well during her first pregnancy, but had had slight dimness of vision towards the end; this, however, had completely cleared up a few weeks after the birth of the child. She had had one miscarriage in March, 1928, and had been curetted.

In her present pregnancy she had been quite well for the first few months except for an occasional fainting turn. She had noticed during the last four weeks that her vision was becoming blurred and that she could not read, as the words seemed to run into one another. Her vision had got worse and this was accompanied by flashes of light in front of the eyes, headaches across the forehead and a feeling of tenderness in the eyes on moving them. She had also noticed that she could not distinguish colours correctly.

Examination revealed nothing abnormal. Her systolic blood pressure was 118 millimetres of mercury and the diastolic pressure was 78 millimetres. The urine was quite normal.

Obstetrically, the uterus corresponded in size with the estimated length of the pregnancy and the pelvis was quite normal. She was sent to the Ophthalmological Department of the Adelaide Hospital for examination of her eyes, with the following result. The vision of the right eye was $^1/_{60}$, of the left $^6/_{60}$. Colour vision was very defective. The pupils were equal and active. Examination of the fields revealed concentric contraction down to 20° on both sides. Refraction was normal. Nothing abnormal was detected in the fundi.

She reported back to the Queen's Home on July 16, 1930, when she complained that her vision was worse. Her urine was normal and her blood pressure the same as before.

Two days later her vision was much worse and she was sent into the Adelaide Hospital for the uterus to be emptied.

Examination of her eyes showed that her vision was now down to perception of hand movements and the concentric contraction of fields was down to 10°. The diagnosis of a retrobulbar neuritis was made, presumably of toxæmic origin.

On July 19, 1930, labour was induced under general anæsthesia by the insertion of two gum elastic bougies with rupture of the membranes. Early on July 21, 1930, a six and a half months fœtus was expelled which lived about four hours.

On July 22, 1930, about twenty-six hours after the birth of the child, her eyes were examined and her vision was $^6/_9$ for each eye and the colour vision practically normal.

A week later she left the hospital quite well. Her eyes were examined again on August 11, 1930, when her vision was found to be $^6/_5$ for each eye; colour vision was normal. The fields were normal and nothing abnormal could be detected in the fundi.

Discussion.

Before labour was induced, the cause of this suggested retrobulbar neuritis was sought. Dr. H. M. Jay reported that there was no evidence of infection in either the ethmoids or sphenoids. An X ray examination of her skull was made by Dr. H. C. Nott, who reported that nothing abnormal could be detected in the cranium. The pituitary fossa was normal both in size and shape, and there was no deformity of the clinoid processes. A Wassermann test was done and reported as without reaction.

No cause for this disturbance of vision could be found and we were therefore compelled to assume that the cause was a toxæmic one. This conclusion was supported by the rapidity with which the blindness cleared up after the source of the toxin was removed. On looking up the literature on the subject we found a very similar case reported by Bailliart and Hartmann.[1] These authors thought that, as they could not find any other signs of toxæmia, the condition might have been syphilitic, although a Wassermann test gave no reaction. Other authors, Patry,[2] Weil and Wilhelm,[3] Frayman,[4] Weekers and Missotten,[5] all quote numerous cases of blindness during pregnancy, but in all their cases evidence of toxæmia or of some kidney trouble had been found.

The reason for thinking that the amaurosis was probably due to a chronic retrobulbar neuritis was based on the following facts: The history of gradual loss of vision and early loss of colour vision associated with the tenderness on moving the eyes is typical of that condition; the concentric contraction of the fields, which became more contracted with the loss of vision, is not unusual in chronic cases of retrobulbar neuritis.

This patient was shown at a clinical meeting held by the South Australian Branch of the British Medical Association, when it was suggested that the condition may have been due to hysteria or that the patient was malingering with the object of having a premature labour produced. This was considered at the time, but the psychology of the patient did not in any way suggest such possibilities and it was felt that the consistency of the fields, which were repeated several times, could not be due to anything but a pathological lesion.

Acknowledgement.

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[5] L. Weekers and R. Missotten: "L'Amaurose Gravidique, Denommée a Tort Amaurose Urémique, Necessite-t-elle l'Interruption de la Grossesse," Archives d'Ophthalmologie, September, 1928, pages 547-553.

Reviews.

SURGERY IN AN EMERGENCY.

THERE is always room for a book that is based upon personal experience; herein lies the chief merit of "Emergency Surgery," by Mr. Hamilton Bailey.[1] But the experiences and opinions of others must always be considered with one's own, and this book is made more valuable by discussion, but not necessarily acceptance, of the views of other workers in the same field. On the whole, the book fulfils its purpose admirably, although one must disagree with some of it. For example, on page 144 "Stovaine" is advocated for spinal anæsthesia, although it is generally agreed that "Novocain" is just as efficacious and less dangerous. On page 267 post-

operative pneumonia (so-called) is described as if it were a mere variant of ordinary lobar pneumonia, and stress is not laid upon the importance of bronchial obstruction and interference with the cough reflex in its ætiology; consequently the treatment prescribed (in four lines) is inadequate. On page 283 there is described an urgent operation for torsion of an ectopic kidney; nephrectomy was done and most surgeons would have been content with this. But not so our author; he removed the appendix *en passant*. These blemishes, however, serve to accentuate the general excellence of this book, which is full of useful instructions and reminders. The Ochsner-Sherren (expectant) treatment of appendicitis of over fifty hours' duration is judiciously discussed. Bailey advises suprapubic drainage after closure of a perforated peptic ulcer practically as a routine; but surely this is not necessary when operation is done within eight or ten hours of perforation. On page 296 nephrostomy is advised for pyonephrosis, but most urologists would probably do nephrectomy if, as is usual, the kidney is dead, and the patient's general condition is good enough to stand the making of an efficiency test of the other kidney; too often after nephrostomy a fistula is left and secondary nephrectomy can be one of the most difficult of operations.

PATHOLOGY FOR NURSES.

"MICROBIOLOGY AND ELEMENTARY PATHOLOGY FOR THE USE OF NURSES," by Charles G. Sinclair, is a text book meant to be studied by nurses while they are being instructed in these subjects.[1] The course of instruction which the book is intended to supplement, consists of thirty-one two-hour periods occupied by lectures, demonstrations and practical exercises. The author has attempted to give his readers a bird's eye view of the wide ground which has to be covered, eliminating all details which are not essential to a broad understanding of the subjects, but including precise information where it is likely to be useful.

It is unavoidable that a book which is intended to convey, however superficially, a general outline of the subjects of bacteriology and pathology, should contain much that will be of no direct practical value to nurses, although the author has constantly borne in mind their requirements.

The book should be useful to any nurse who wishes to understand and intelligently cooperate in bacteriological or pathological investigations required by the patients under her care. It should also be of great value to lecturers as an aid in arranging a course of instruction for nurses and in selecting information likely to be useful to them.

DIFFERENTIAL DIAGNOSIS.

IN March, 1928, we reviewed the ninth edition of Dr. Cabot's "Physical Diagnosis." We have before us now the English issue of the tenth edition.[2] The preface informs us that new matter has been introduced relating to coronary disease, electrocardiography, cancer of the lung, "cardiac asthma," toxic hepatitis and *encephalitis lethargica*. Frankly, much of this is disappointing. Thus, of cancer of the lung we could find only a few words inserted amongst diseases of the pleura. It is true that electrocardiography is fairly described and that there is something on coronary disease, though insufficient to distinguish it from *angina pectoris*, but of the other new subjects we could find only the barest mention.

The book remains intensely personal; it describes the author's own experience with complete indifference to

[1] "Microbiology and Elementary Pathology for the Use of Nurses," by Charles G. Sinclair, B.S., M.D.; 1931. Philadelphia: F. A. Davis Company. Royal 8vo., pp. 362, with 102 illustrations, some in colour. Price: $2.50 net.

[2] "Physical Diagnosis," by Richard C. Cabot, M.D.: Tenth Edition, Revised and Enlarged; 1930. London: Baillière, Tindall and Cox. Royal 8vo., pp. 550, with six plates and 279 figures in the text. Price: 25s. net.

accepted authority. Thus, because he himself has very rarely seen hydatids, he does not mention hydatid of the lung among the possible causes of hæmoptysis. He tells us nothing of the laryngoscope and the ophthalmoscope nor of "Lipiodol," because he does not himself use them.

The illustrations are profuse and beautiful, but many of them depict extreme cases or rare curiosities rather than examples ordinarily encountered in practice.

The book seems to have been entirely printed and produced in the United States of America, and this accounts for its very high price and makes it all the more delightful that the English is so good—far superior to that employed by most foreigners.

Dr. Cabot appears to be a highly capable physician, and his experienced colleagues may well benefit by studying his opinions. The student who desires a reference text book will wisely prefer one of the several cheaper and more complete English works.

GASTRO-ENTEROLOGY.

A PRACTICAL treatise on diseases of the digestive system, from the pen of L. Winfield Kohn, of New York, is a handy work on this rather extensive subject.[1] It is presented in two volumes of some five hundred pages each, and most profusely illustrated.

The illustrations are to the point and, in the main, good. There are, as one would expect in dealing with the subject, a great number of reproductions of X ray films; these have been well chosen and admirably illustrate the text.

Volume I deals with the anatomy, histology and physiology of the digestive tract, history taking, methods of diagnosis, and specifically with the diseases of the buccal cavity, the œsophagus and the stomach. The book does not really gain by the chapter on the anatomy of the digestive tract. The subject is dealt with in a general way; it will not interest the specialist on one hand and will not suffice the student or junior practitioner on the other. The same may be said of the chapter on physiology.

History taking, clinical examination of the patient, the use of modern methods in diagnosis *et cetera* are very fully dealt with.

Fifteen pages and no less than thirty-two illustrations are devoted to the gastro-photor, an instrument elaborated in Vienna and used for intragastric photography. The author is more at home in discussing the significance of secretory and excretory findings. Mention might have been made of Ryle's modification of Einhorn's duodenal tube.

The diseases of the stomach and intestinal tract (Volume II) are fully dealt with. We would wish for a little more concise description in many cases, the author tending at times to be a little rambling, for instance, in the description of the signs and symptoms of duodenal ulcer. An indication, too, in regard to the relative value of each of the enumerated causes in the actual production of the disease under discussion would not be amiss.

The chapter on the "Parasites Causing Gastro-Intestinal Pathology" is exceptionally good and the illustrations are extremely valuable. A large proportion of the second volume is given up to various methods of treatment, and many pages are devoted to formulæ. These include formulæ for gastric, duodenal and jejunal feeding and for nutrient enemata. There are also extensive charts given, showing the relative amounts of iron in the various foods and their calcium, chloride, phosphorus and water content.

Complete diet lists suitable for the various diseases are given, and should prove helpful. Considering the amount of material covered, Dr. Kohn has presented a very readable and useful work, the language is refreshingly simple, his references are profuse and we are pleased to note that they are not totally confined to the observers of the New World.

[1] "Practical Treatise on Diseases of the Digestive System," by L. Winfield Kohn, M.D., F.A.C.P., Volumes I and II; 1930. Philadelphia: F. A. Davis Company. Royal 8vo., pp. 1156, illustrated with 542 engravings, including 7 full-page coloured plates. Price: $12.00 net.

The Medical Journal of Australia

HEALTH AND THE PUBLIC.

IN his annual report for 1929, Sir George Newman, Chief Medical Officer of the Ministry of Health of Great Britain, stated that "as only an educated people can be an effective people, so also only an enlightened and willing people can be a healthy people." This sentence is pregnant with truth. During the last few decades the expectation of human life has increased. Several factors are responsible for this and not the least are the achievements of preventive medicine and health administration. Economic factors, of course, are of importance. Working hours are shorter and opportunities for recreation correspondingly greater. Provisions for better housing and the initiation of Pure Food Acts have reduced the incidence of disease and improved the nutrition of the people. To enumerate the ways in which preventive medicine has contributed to the increased expectation of life would require a great deal of space. For the present purposes it is not necessary to make the attempt. It is necessary, however, to point out that measures for the betterment of health have usually been introduced as compulsory enactments and that the people have been more or less dragooned into complying with certain regulations. Doubtless the continued enforcement of health act provisions does in time result in a certain complaisance with varying degrees of understanding. Progress by compulsion has been effective in the past up to a certain point and will still be made. Other means must be pressed into the service. Sir George Newman refers to an enlightened and willing people as those only who can be healthy. While this may be accepted as true, the aim of health authorities should be the production not only of an enlightened and willing people, but also one that will cooperate, and on occasion demand further advance. The question is one of degree. A willingness to comply with the demands of the law may be the outcome either of inherent laziness or of understanding. Understanding carried far enough results in cooperation.

Sir George Newman sets out the several ways in which the nation may be educated in the "art of healthy living." The best way, in his opinion, is experience in its practice or lack of practice. He shows that the development and extension of sanitation and of the public health service in England has itself proved one of the most effective means of education in health. He describes as not less educative the public medical services for health insurance, maternity, infant welfare, the care of the school child and the control of infectious diseases. The same may be said of the Commonwealth, although it has not so long a history behind it. The series of articles from the pen of Dr. J. H. L. Cumpston on the history of public health in Australia which are at present being published in this journal, is important in this connexion. In the present discussion emphasis will be laid on only two of the means of teaching referred to by Sir George Newman; one is the school medical service and the other is the lay and professional press.

The power of the press need not be emphasized. Unfortunately, it has not been possible to produce the popular health magazine for Australia that was planned a year or two ago. Reliance must, therefore, be placed on the daily and weekly newspapers. Newspapers disseminate information and they also mould public opinion by their interpretation of

facts. This is not the place in which to discuss the burden of responsibility of newspaper editors. Signs are not wanting that the newspaper editors in the Commonwealth are ready and anxious to supply their readers with accurate information on matters of health and disease. There is a difference between the sensational report of some supposedly marvellous cure and the straightforward statement of fact in regard to a disease or a health measure. The latter are seen much more often than the former. That a garbled statement sometimes appears is perhaps due to failure to refer the matter in question to a medical practitioner who could give advice. Many newspapers, of course, have attached to their staffs a medical man capable of giving help by directing attention to what is of real importance; others have not seen the wisdom of this course. For the general newspaper reader medical news should be accurate, but it must also be made attractive. Some people will not read a serious article on infectious diseases or on antenatal treatment, for example, but they will read "The Diary of a Doctor who Tells." (And here it may be stated that readers of the latter class—the readers who must have their medicine coated with sugar or even with chocolate—are given many an important lesson in preventive medicine by such writers as the discriminating author of this "diary.") We look hopefully for the time when there will be some *liaison* between the medical profession and the daily newspapers.

The school medical services with their regular inspection of children and their interviews with parents are carrying out a useful work by instilling into the minds of the young the lesson that health is worth seeking and that it can be gained. If the medical inspector of school children has a lively sense of duty, he or she will explain to the children the object of the inspection. There is no reason why the child should not be brought to regard the health of the community as a necessity and himself as an important unit of the whole. A child enlightened is much more likely to be willing and ready to co-operate in later years in attaining the ideal than he is if no health instruction is given to him until he has reached the years of indiscretion.

Current Comment.

EXPERIMENTAL OSTEITIS FIBROSA.

NOT a great many years have passed since the discovery that the parathyreoid bodies were of importance in metabolism, and that the benefit derived from the administration of extract of thyreoid gland was often due to the presence of extract of parathyreoid. Recently a great deal of attention has been given to the parathyreoids and much work has been done. While for some time it has been recognized that the parathyreoid hormone is in some manner concerned in the calcium metabolism, nothing was known until lately of its mode of action. It was realized that calcium deficiency and parathyreoid deficiency often existed together and that the administration of parathyreoid extract relieved the tetany of hypocalcæmia. It was observed that such diseases as osteomalacia were sometimes associated with abnormalities of the parathyreoids and that in such conditions the excretion of calcium was abnormally high. The preparation by Collip of "Parathormone," a highly efficient extract of the parathyreoids, led to a greatly increased facility for the study of the action of these glands. It has been discovered that in some instances an apparent calcium deficiency is not so much a deficiency of calcium in the body as in the blood. Hypercalcæmia and excessive excretion of calcium are due to the excessive secretion of parathyreoid hormone, which causes the bones to yield calcium and phosphorus. In fact, though it seems strange and paradoxical, "Parathormone" has been administered so that calcium may be stolen from bones and poured into the circulation for the more rapid healing of fractures; this treatment has apparently met with success.

It would seem that the rationale for the administration of calcium and parathyreoid extract in the treatment of some diseases characterized by disturbance of calcium metabolism was originally based on false premises. The treatment is often successful, not because it corrects a condition of hypoparathyreoidism, but because it causes more calcium from the bones to enter the blood stream.

The subject of parathyreoid function has been dealt with in these pages by Corlette and others and the association of hyperparathyreoidism with *osteitis fibrosa cystica* has been mentioned. Recently Henry L. Jaffe, Aaron Bodansky and John E. Blair reported the results of the experimental administration of large doses of "Parathormone" to guinea-pigs.[1] The object of their experiments was to observe the effects of experimentally induced hyperparathyreoidism. One single large dose (20 units per 100 grammes of body weight) was administered to each of a number of young guinea-pigs and to each of a number of adult guinea-pigs. Repeated doses were administered to some young guinea-pigs and the effects of intermittent administration of "Para-

[1] *Archives of Pathology*, February, 1931.

thormone" were observed on young guinea-pigs of another series.

Six hours after the injection of a single large dose of "Parathormone" into a young guinea-pig, the marrow of the ribs near the costo-ehondral junction was congested and osteoclasts were present beneath the periosteum; at the end of forty-eight hours there was a condition of extensive resorption of bone, the cortical portions of the ribs were deeply excavated and osteoclasts were numerous, the marrow cavity contained fibrous tissue and extensive hæmorrhage, the cortex near the costo-chondral junctions was fractured. There was little increase in the blood calcium content of animals which had been fed up to the time of the experiment, but a great increase occurred in fasting animals. In the bones of adult guinea-pigs after a single large dose of "Parathormone," there were no obvious histological changes, but the blood calcium content rose considerably above the normal. The authors suggest that a relatively larger dose should have been given to the adult animals.

The administration of repeated moderately large daily doses of "Parathormone" to young guinea-pigs resulted in resorption of bone, enlargement of the Haversian canals, fibrosis of the marrow cavity, the formation of blood sinuses in the bone, necrosis and hæmorrhage. The effects were most severe when several very large doses only were administered; in these instances the animals all died before the blood could be examined; in addition to other appearances, there were large cystic spaces in the marrow near the costo-chondral junction and in the metaphysis. In this series it was found that repeated small daily doses protected the animal to a large extent from the effects of several very large doses administered from one to three weeks after the commencement of the experiment.

In the bones of animals which were intermittently treated with moderate and large doses of "Parathormone" the changes were generally similar to those observed in the other experiments. Cysts and so-called osteoid tissue were seen only in the bones of those animals which were destroyed some days after the final injection of "Parathormone." The authors deduce from this that the formation of osteoid tissue and cysts in the course of *osteitis fibrosa* is a feature characteristic, not so much of the lesion produced by hyperparathyreoidism as by its repair. In this series it is notable that the blood calcium content was low, due probably to the utilization of all available calcium in the healing of numerous fractures which occurred after the final injection.

In all the experiments on young animals the lesions were generalized throughout the skeleton; the ribs were selected for study only for the sake of convenience.

Jaffe, Bodansky and Blair believe that the lesions observed in their experiments were those of *osteitis fibrosa*. There seems to be little doubt that they are correct and that the lesions were due to the condition of hyperparathyreoidism experi-mentally induced. The association of tumours of the parathyreoids with a condition of *osteitis fibrosa* has been noted by more than one observer. Surgical removal of the parathyreoids has been practised on occasions; this procedure is said to have resulted in increased calcification of the skeleton and decrease in the quantity of the blood calcium and in the quantity of calcium excreted. Of course the most severe effects observed by Jaffe, Bodansky and Blair resulted from the sudden pouring into the circulation of great quantities of parathyreoid hormone—a condition which may not occur in nature. Still, a periodical over-stimulation of the parathyreoid gland is a possibility which may be readily conceived; this would fit in with the views of these investigators in regard both to the causation of the lesions and the formation of osteoid tissue. This aspect of parathyreoid function requires further investigation.

THE VALUE OF RAMISECTION.

IN October, 1930, a suggestion was made in a leading article in this journal that the College of Surgeons of Australasia should appoint special committees to investigate the condition of patients on whom the operation of ramisection was performed, with a view to determining its value. This suggestion was the outcome of the publication of a report in *The Lancet* in July, 1930, condemning the operation as having "no place or value in the treatment of spastic weakness." At the recently held annual meeting of the College of Surgeons of Australasia, the President, Sir Henry Newland, announced that, in accordance with the suggestion made in these pages, a committee had been appointed to carry out the investigation in Victoria. The members of the committee are: Professor F. Wood Jones (Chairman), Sir Richard Stawell, Dr. Fay Maclure, Dr. H. C. Trumble, Dr. A. E. Coates, Dr. J. B. Colquhoun and Dr. H. F. Maudsley. This is a matter for congratulation. The New South Wales committee has not yet been appointed. More patients are submitted to ramisection in New South Wales than in any other State. An announcement in this regard is overdue. Valuable time is being wasted.

THE BRITISH JOURNAL OF PHYSICAL MEDICINE.

WE have been asked to announce that in future the *British Journal of Actinotherapy and Physiotherapy* (17, Featherstone Buildings, London, W.C.1) will be published under the title: *The British Journal of Physical Medicine* (incorporating the *British Journal of Actinotherapy and Physiotherapy*). The alteration will take effect from the issue of April, 1931, which forms the first number of Volume VI. The new title will indicate more clearly the subjects covered by the journal—actinotherapy, heliotherapy, electrotherapy, radiotherapy, hydrotherapy, climatotherapy, massage, exercise and so forth.

Abstracts from Current Medical Literature.

PÆDIATRICS.

Use of Phenobarbital in Infant Feeding.

E. J. BARNETT (*Archives of Pediatrics*, July, 1930) comments on the value of phenobarbital ("Luminal") in infantile vomiting and colic. He reports a successful issue in eight supposed cases of pyloric stenosis and two of pylorospasm; this drug was used in doses of eight to sixteen milligrammes (one-eighth to one-quarter of a grain) intimately mixed with thickened cereal food and one drop of one in a thousand solution of atropine sulphate. The vomiting or colic has been rapidly relieved and body weight immediately increased. The patients were nearly all treated in hospital and were kept in quiet surroundings. The author explains this result as due to a direct effect on the vomiting centre, which he thinks may be hypersensitive in congenital pyloric stenosis. He would attribute the beneficial action of atropine to a paralysis of the afferent rather than the efferent vagal endings of the stomach.

Anæmia and Liver Therapy in Infancy.

A. C. HAMPSON AND E. C. WARNER (*Archives of Disease in Childhood*, October, 1930) publish a review of juvenile anæmia and its response to liver therapy. By means of the Van den Bergh test these disorders are divided into the hæmolytic and nonhæmolytic groups. The former includes: (i) True pernicious anæmia, of which the authors quote examples, frequently of very rapid onset; (ii) acholuric jaundice, which responds satisfactorily after a latent period to adult doses of liver and may tide an infant over a hæmolytic crisis until splenectomy can be performed, particularly if blood transfusion, preferably into the median basilic vein is also used; (iii) hæmolytic anæmia, obviously of infective origin; (iv) congenital anæmia or anæmia occurring in the early months of life, of obscure origin, perhaps infective or an exaggeration of the normal hæmolysis occurring soon after birth. The value of liver therapy in these conditions is most striking and appears to be directly proportional to the increase of electrical potential at the surface of the red cells, a phenomenon already shown to exist in the hæmolytic anæmias by one of these authors (Hampson). As regards non-hæmolytic anæmia there is no evidence that the administration of liver is of any certain benefit.

The Psychiatric Aspects of Enuresis.

F. N. ANDERSON (*American Journal of Diseases of Children*, September-October, 1930) discusses enuresis from the psychiatric standpoint. In a large control group nocturnal bladder control was secured at an average of twenty-three months, with an average duration of a training period of six months. The author concludes that restriction of fluid is of little fundamental value and that emotional factors are the largest elements responsible for the causation, or more frequently, the continuance, of the enuresis. Physical factors, for example, need for circumcision, may act by suggestion indirectly through erroneous assumptions by parents and others. Previous illnesses are important, since they usually mean a relaxation of habit training. Infantile traits appear to be of high incidence. Timidity, sensitiveness and nail-biting occur in a high proportion. Though the intelligence of patients is above the average, feelings of inferiority are very common and lead to continuance, fostered frequently by parental attitudes, such as "failure" and "severity." Ultimately the act resembles a conditioned reflex. Only about 11% of patients manifest the combined day and night type; four-fifths show only the nocturnal type. Seven *per centum* are complicated by rectal incontinence. Eighty *per centum* go back to infancy, the persistence of a once "normal" habit. Enuretic children show remarkable results in response to properly supervised hospitalization.

The Tonsils and Naso-Pharyngeal Epidemics.

W. H. BRADLEY (*Archives of Disease in Childhood*, October, 1930) has attempted to discover the effect of tonsil and adenoid removal on the health and incidence of droplet infection among 289 public school boys. Examination of a "sample" of the school in midsummer revealed the fact that only 36% of 167 operations could be considered as surgically successful. In only 18% of cases has complete eradication been performed. The proportion of these successes was no higher in the "never ill" than in the "habitually ill" groups. In the unoperated groups large tonsils were the rule rather than the exception. The author regards this as "*post hoc*" to disease, and physiological. He holds the same view in regard to granular pharyngitis. In regard to cervical adenitis, he found that there was an equal distribution between the above two groups, suggesting a compensatory hypertrophy of lymphoid tissue in the neck and naso-pharynx after operation. The author suggests that there is an optimum amount of lymphoid tissue necessary for protective purposes, and until compensatory hypertrophy occurs following operation, there is increased liability to catarrh in susceptible persons. The other part of this inquiry is concerned with the incidence of catarrhal disease in relation to the throat appearances in health. In contradistinction to Paton's hypothesis of a single causal organism for all mucous catarrh, the location and character being determined by secondary invaders, the author suggests that many different organisms may produce the same clinical reaction in the one site of the nasal mucosa, as *formes frustes* of their respective diseases. Of the boys investigated 82% suffered from naso-pharyngeal disease. Recurrence of attack was frequent in the boys with the largest tonsils, but complications occurred most frequently in the operated group, particularly in those in whom eradication had been most complete. There was evidence that tonsillectomy had not protected against *otitis media*. Uncomplicated naso-pharyngitis occurred irrespective of the presence or absence of tonsil. Autoinfection from chronic tonsillitis was rare. The droplet infections, according to the author, have little to do with the tonsil or its removal. "Tonsillectomy is symptomatic treatment in its elementary form."

Primary Arterial Hypertension in Childhood.

ROBERT HUTCHISON AND ALAN MONCRIEFF (*British Journal of Children's Diseases*, July-September, 1930) report a case of primary hypertension in a child aged eight and a half years. There was no family history of the disease. Scarlet fever had occurred nine months before. The child gave a history of previous fits associated with two weeks' unconsciousness, and complained of headache, shivering and occasional vomiting; she seemed apathetic and miserable. No abnormality could be found in the central nervous system and the cerebro-spinal fluid was almost normal. Her heart, however, was found to be large and her systolic blood pressure was 180 and the diastolic blood pressure 120 millimetres of mercury. Her urine was clear and her blood urea thirty milligrammes *per centum*. At autopsy the brain was congested and œdematous, but otherwise normal. The heart showed concentric hypertrophy. One kidney was three times the size of its fellow, but both were microscopically normal, including the coats of the blood vessels. No abnormality was found in any other organ, including the ductless glands. The authors hold that this case proves that convulsions and coma can occur in hypertension, quite apart from any renal failure or gross cerebral lesion. They are probably vascular in origin.

Hæmoglobinuria in the New-Born.

JEAN SMITH (*Archives of Disease in Childhood*, August, 1930) reports a fatal case of hæmoglobinuria in a female infant a month old. At *post mortem* examination staining of the kidney for iron showed hæmosiderin localized to the renal cortex and apices of the pyramids. The fragility of the red cells was also increased and the author suggests ætiological relationship between the latter and an original infection. She denies that von Winckel first discovered the disease, as this was unwittingly shown earlier by Otto Pollak (1871). Its epidemic character is usually associated with one of puerperal fever and both have probably the same streptococcal origin. The author recommends the term

"infective hæmoglobinuria of the new-born" as more appropriate than Winckel's disease. The doubtfully positive Wassermann reactions obtained in this and in paroxysmal hæmoglobinuria are also common to certain exanthems and other streptococcal infections, while its dangerous character is probably due to "renal suffocation" by hæmatin and occurs after the transfusion of incompatible blood unless extra fluid and alkalis are supplied. Hæmoglobinæmia identified by a generalized dusky discoloration of the skin, precedes the hæmoglobinuria by several days. Icterus also occurs early in the less severe illness, due to a greater hæmolysis than the liver can deal with.

ORTHOPÆDIC SURGERY.

Tuberculosis of the Joints of the Lower Extremities.

R. A. HIBBS (*The Journal of Bone and Joint Surgery*, October, 1930) claims on broad general lines that in undisputed cases of tuberculosis of the joints of the lower extremities cure does not take place unless bony ankylosis is achieved. It is unsafe to claim a cure unless the diagnosis has been established by methods which are more reliable than those which have been used in the past and which are still being used in clinics today. Conversely, in those cases in which he has undertaken operative fusion of the joints in the lower limb, in no instance has there been a recurrence of the disease, and limitation of the patient's activity, which might have been expected, has not been experienced. This is especially true of children, and particularly when the hip, the ankle and the tarsus are affected, the patients being almost entirely free from handicap in ordinary activity. Of still greater importance is the fact that these patients have been freed from the constant danger to life by extension of the disease from the active focus in the joint, as well as from the necessity of years of treatment in hospital or clinic.

H. L. GRASSO (*The Journal of Bone and Joint Surgery*, October, 1930) discusses the non-operative treatment of tuberculous joints of the lower extremities and emphasizes the fact that tuberculosis is a systemic and not a local disease. The patient with a tuberculous joint should be treated for the systemic infection and the joint should be treated as a complication and not as the site of primary infection. Operative procedure, especially if undertaken during the acute stage, is likely to disseminate the disease. If surgical operation must be resorted to, it should be done after a preliminary course of conservative treatment so as to bring the resistance of the patient to a maximum. In the author's experience conservative treatment usually results in healing, with useful motion and retention of that motion without recurrence of the disease. In discussing the author's paper, E. W. Ryerson, F. C. Kidner, J. Wilson and C. F. Eikenbary expressed their opinions of the operative method of fixation advocated by Hibbs as representing the real progress of this generation in surgical treatment of joint tuberculosis. Eikenbary emphasized his opinion that even large abscesses do not contraindicate operative fusion. In fifteen cases there was no breaking down of tissue following fusion, but in these circumstances there is a tendency for a longer period of time to be necessary before complete fusion occurs.

Suppurative Tuberculosis of Joints.

O. FLIEGEL (*The Journal of Bone and Joint Surgery*, October, 1930) describes his method of administering calf spleen to patients suffering from tuberculosis of joints, and considers that it has a beneficial effect on these conditions in the human being. The calf spleen is given in as raw a state as possible in order not to disturb the active substances. The daily dose consists of fifty to one hundred grammes. This is given for four weeks, followed by an intermission of fourteen days. It may be necessary to repeat this administration several times. This diet is harmless and should be tried in all severe infections of this kind. The beneficial results to be anticipated are rapid fall in temperature, diminution of suppuration, appearance of healthy granulations in the tuberculous region within eight to fourteen days, disappearance of œdema surrounding the fistula and of pain in the joint, and improvement in the general condition, colour, weight and blood picture. Radiographic evidence of improvement is slower in appearing. The author emphasizes the fact that the necessary orthopædic treatment should not be neglected.

Oscillometry in Peripheral Vascular Disease.

S. L. SIMPSON (*Proceedings of the Staff Meetings of the Mayo Clinic*, September 24, 1930) states that oscillometry is of great value in the study of peripheral vascular disease, particularly in quantitative diagnosis. As a prognostic or therapeutic index it is inferior to estimation of the surface temperature. Oscillometric values are subject to physiological variations. Stimulation or paralysis of vasomotor nerves affects arteries as well as arterioles. Hot and cold stimuli appear to have a direct action on the arterial muscular wall after sympathetic ganglionectomy.

Lumbar Sympathectomy after Anterior Poliomyelitis.

R. I. HARRIS (*The Journal of Bone and Joint Surgery*, October, 1930) is of the opinion that lumbar sympathectomy performed upon patients suffering from paralysis of the leg due to anterior poliomyelitis produces the same vascular changes that have been observed in normal patients, namely, increased warmth and dryness of the foot due to vaso-dilatation and to paralysis of the sweat glands. The calorimetric readings indicate that sympathectomy causes considerable increase in the blood supply to the foot. His findings are that vascular changes are of prolonged duration and perhaps are permanent; the rate of growth of a child's leg may be accelerated by the operation of lumbar sympathectomy; the increase in comfort which results from transforming the cold, blue, damp foot to one which is warm and dry, is much appreciated by the patient.

Paralytic Genu Recurvatum.

LEO MAYER (*The Journal of Bone and Joint Surgery*, October, 1930) describes a method of treating severe grades of *genu recurvatum* by inserting a bone graft into the upper end of the tibia. The graft fuses with the tibia and the patella and forms a bone block which effectually prevents hyperextension. The graft bears the same relationship to the tibia as the olecranon process to the ulna, and the operation can be summarized as a conversion of the knee joint into an elbow. Great care must be taken not to maintain the overcorrected position too long, otherwise a flexion contracture is likely to ensue.

Non-Traumatic Dislocations of the Atlanto-Axial Joint.

E. J. BERKHEISER AND F. SEIDLER (*The Journal of the American Medical Association*, February 14, 1931) describe five instances of non-traumatic dislocation of the atlanto-axial joint occurring in patients confined to bed for some upper respiratory infections and in which radiographs showed no destruction of bone. They consider that the dislocation is due to the softening effect on the *ligamentum transversum atlantis* and the posterior and anterior ligaments of an effusion in these joints, probably streptococcal in origin. A striking feature in this series was torticollis without evidence of nerve injury, except for the peripheral nerve irritation. The authors describe the methods of obtaining good radiographs and their methods of reduction, which consist of constant traction in hyperextension followed by immobilization and the use of plaster casts.

Lunate Osteomalacia.

E. S. BLAINE (*The Journal of the American Medical Association*, February 14, 1931) describes the symptoms and radiographic appearance of lunate osteomalacia or Kienbock's disease. It frequently follows very slight trauma and is manifested by gradual onset of pain in the affected region. This pain tends to recur after mild trauma and ultimately softening and absorption of bone take place, to be followed at a later stage by osteosclerosis. The surgical removal of the diseased bone does not materially reduce the disability, which is frequently great.

Special Articles on Diagnosis.

(Contributed by Request.)

XLVI.
HEART DISEASE.

THE aim of diagnosis in heart disease is to determine the capacity of the heart to maintain an efficient circulation. As James Mackenzie pointed out, the whole study of cardiac disease centres around heart failure. The examination of a patient suffering from heart disease reveals the presence of failure of the heart or renders possible the recognition of structural changes which foreshadow its failure in the future. When heart failure is well established, it presents, in the majority of instances, few difficulties of diagnosis. But it is more difficult, and in some respects more important, to recognize the earliest signs of failure or to foresee it before it comes. The recognition of the necessity for early diagnosis and the difficulty inherent in this have induced in many practitioners a fear that early heart disease may pass undetected by them. This fear has led to many an erroneous diagnosis which has inflicted injustice and misery upon the patient. Also many patients rationalize their symptoms incorrectly as arising from the heart. So it comes to pass that "a large proportion of those who think or fear they have heart disease, turn out on careful examination to be free from it."[1] By a careful evaluation of symptoms and signs it is possible to avoid such errors to a large extent.

If the heart actually is failing, the diagnosis of this fact is made from the history and from the examination of other organs than the heart. In patients in whom structural changes are present, which may lead to failure of the heart in the future, the diagnosis rests mainly on the examination of the heart itself.

THE SYMPTOMS AND SIGNS OF FAILING HEART.

There are two forms of heart failure, namely, heart failure with congestion and heart failure with pain.

Heart Failure with Congestion.

The cardinal signs of heart failure and congestion are œdema, orthopnœa, enlargement of the liver and cyanosis. These are the signs of advanced heart failure, but usually before they appear evidence is available from the symptoms that an early stage of failure is present. There is no more important part of the examination than an evaluation of the symptoms disclosed by the history, especially breathlessness, pain, fatigue and the response to exercise. The most important evidence is that of deficient exercise tolerance.

An estimate of the response to exercise is obtained most reliably from the history, that is, from the account given by the patient of his capacity to perform familiar tasks. Many exercise tests have been proposed by which it is claimed that an estimation can be made as a clinical observation with almost the same mathematical accuracy as in a blood count. These tests are of very limited value, because they can take no account of the nervous factors at work, because it is impracticable to use the same exercise test for all, irrespective of their age, bulk, habits *et cetera*, and because there is no basis of comparison in each patient with response to similar physical work under normal conditions.

The exercise tolerance is a matter for judgement rather than observation. The most dependable opinion is founded upon close cross-questioning of the patient as to the degree of discomfort attaching to the performance of the usual daily routine, such as the occurrence of dyspnœa or pain or fatigue (of a degree judged to be untoward to the patient) in ascending stairs, walking up hills or inclines or even walking along the level street.

Thomas Lewis has summarized the interpretation to be placed upon a deficiency in the exercise tolerance as follows:

1. In the presence of definite enlargement of the heart, aortic disease, mitral stenosis, or fibrillation of the auricles, any undue distress after exercise should be attributed to cardiac disease.

2. In young subjects, if none of the above four conditions is present, a definite diminution of exercise tolerance should rarely be attributed to the heart. Tuberculosis and other infections are likely.

3. In the elderly, in whom there is no sign of structural change, if the exercise tolerance is poor, the heart should be blamed. Such persons are liable to suffer from *angina pectoris* or from myocardial damage, in which the chief symptoms may be breathlessness or undue fatigue rather than pain.[2]

When heart failure with congestion is advanced, the cardinal signs already mentioned are present. Some of these will be discussed later.

Heart Failure with Pain.

Heart failure with pain occurs with *angina pectoris* and in coronary occlusion. The latter is such a clearly defined clinical entity that it will be given separate presentation.

Cardiac pain is often the chief evidence of heart failure. It sometimes occurs in patients who present no clearly perceptible signs of structural change, such as cardiac enlargement, and must be distinguished from less serious forms of cardiac pain sometimes present in patients who have no organic disease. The relevant facts in diagnosis are:

1. Grave *angina pectoris* is a malady of middle life or advanced years.

2. Exercise is the chief provocative cause of pain in both types, but in grave angina the attack of pain is not experienced while the subject rests in bed, unless it is brought out also by mild exercise. In the milder form of cardiac pain, the attacks are not infrequent at night time and may be confined to resting hours.

3. Grave angina starts usually in the sternal region; the less serious type of cardiac pain starts in the region of the precordium. (Except in mitral stenosis, great cardiac enlargement and acute pericarditis, pain over the apex is not due to organic heart disease.) The radiation to neck and arms is very similar in the two types. Hyperæsthesia is present in both and over similar areas.

4. Signs of structural heart disease are often, though not always, present in the grave form, and alternation in the strength of the pulse beats (*pulsus alternans*) is frequently displayed; not so in the less serious form.

5. In the less serious form the patient is usually highly strung and is often the subject of neuroses. He has the "effort syndrome," rapid heart action being the rule, and the response of the heart rate to exercise is exaggerated.[3]

THE SIGNS OF HEART DISEASE.

There are certain cardinal principles of physical diagnosis to be clearly recognized.

Age. Only in very rare and exceptional instances is it justifiable to diagnose heart disease in patients under forty years of age in the absence of one or more of certain chief reliable signs. In the elderly the contrary is true.

The Chief Reliable Signs.

The chief reliable signs are eight in number, five to be detected in the examination of the heart and three in the examination of other organs: (i) Definite signs of enlargement of the heart, (ii) a definite precordial thrill, (iii) an undoubted pericardial friction rub, (iv) a diastolic murmur, (v) an abnormal rhythm, especially one in which gross irregularity is present, persisting when the heart rate is over 120, (vi) distinct over-distension of the veins of the neck, (vii) expansile pulsation of the liver, (viii) generalized arterial disease or a persistent high blood pressure (180 or over).

It has been said that in exceptional instances a diagnosis of heart disease is allowable in spite of the absence of any of the chief reliable signs. Such instances are *angina pectoris*, certain conditions revealed by the electrocardiograph, acute and subacute bacterial heart disease and definitely lessened exercise tolerance in elderly patients.

In some instances also a firm diagnosis is not possible because in syphilis, acute rheumatic fever, chorea and hyperthyreoidism sufficient time may not have elapsed to determine if cardiac damage has occurred. For these latter exceptions the term "potential heart disease" has been rightly suggested.

Enlargement of the Heart.

The size of the heart is variable in normal people, the weight of the heart muscle being related to the weight of the general somatic musculature. Therefore allowance must be made for this. All measurements of the heart in the living are only approximate. The most reliable physical sign indicating the size of the heart is the position of the apex beat. When the chest is palpated a maximal impulse can be felt. This is a definitely palpable thrust, recognizable as being caused by the push of the underlying heart muscle, and is to be distinguished from an indeterminate flicker sometimes felt over the precordium. The maximal impulse is usually felt over a circumscribed area of about 2·5 centimetres (one inch) in diameter. The outermost margin of this circumscribed area is the apex beat. It is the best clinical guide we possess to the left border of the heart, and, providing the heart is not displaced, to the size of the organ. A well defined maximal impulse which lies beyond the natural limits, namely, an impulse situated more than 11·25 centimetres (four and a half inches) to the left of the mid-sternal line or quite clear of the nipple line, is to be taken as a definite sign of the heart's enlargement. The sign is all the more emphatic if it is discovered in the sixth interspace; it is less emphatic if found in the fourth. The position of the apex beat when so abnormally displaced is evidence of the size of the heart as a whole and no decision is possible as to the relative amount of dilatation and hypertrophy which is present. "To assess the comparative degrees of hypertrophy and dilatation is rarely, if ever, possible. It is probable that in almost all instances where the heart is permanently enlarged, hypertrophy and dilatation are coexistent; to estimate the relative degrees of muscular growth and stretching in the living man is not possible; it is, moreover, unnecessary."[4]

Dilatation may be diagnosed as the predominant change only when the position of the apex beat has been observed on repeated examinations to move in the course of a few hours or days.

Percussion of the heart is of much less value than palpation. In some instances an approximate knowledge of the position of the left border of the heart can be obtained. When this is situated abnormally to the left, it is an indication of the presence of ventricular enlargement without reference to which ventricle is involved. It is not necessarily of itself indicative of dilatation or of hypertrophy of the left ventricle.

Percussion of the right border of the heart is of value only when the organ is displaced. It is difficult or impossible of accomplishment with any degree of accuracy and has little or no clinical value except in detecting or aiding to detect displacement of the heart. When the heart is not displaced and a right margin is recognized by percussion, it has relation, not to the ventricle, but to the right auricle, and we possess in the over-distension of the veins of the neck a much more reliable indication of enlargement of the right auricle.

The most reliable indication of the size of the heart is obtained by X ray examination carried out with a proper technique, and in case of doubt it is a method which should be used.

Enlargement of the heart is a cardinal sign in many patients with heart disease and may be present when the valve lesion is insignificant, when hypertension is not present and when no adhesive pericarditis exists. There is an unknown factor in the causation of hypertrophy.

In many patients the presence of demonstrable enlargement solves the question of the significance of a murmur.

A Definite Precordial Thrill.

To be significant, a thrill must be distinguished from a slight vibration or a "suggestion of a thrill," which may be found in normal hearts, especially in young adults when the heart is beating vigorously after exercise or excitement. (At the apex in mitral stenosis, at the base in aortic and pulmonary stenoses—when it is essential to the diagnosis—and in syphilitic aortitis, a definite purring thrill is a cardinal sign of structural change.)

An Undoubted Pericardial Friction Rub.

Rarely is an undoubted pericardial friction rub unaccompanied by other definite evidence. In the acute pericarditis of rheumatic heart disease, it is accompanied by precordial pain, usually of severe grade, and in coronary occlusion it is frequently one of the several features of a grave clinical picture.

A Diastolic Murmur.

The time has surely passed when it should be necessary to belabour the point that a systolic murmur, as an isolated physical sign, is of very slight significance as evidence of heart disease. The presence of a systolic murmur means no more than that the examination of the heart must be carried out carefully to determine if there are definite signs of cardiac disease. If this sign is present, it is not the murmur, but such evidence as the careful estimation of the size of the heart, the occurrence of rheumatic fever in the past or the diminution of exercise tolerance which decides the question.

Time and again hearts which have shown persistent systolic murmurs during life have been found quite normal at autopsy. This statement applies to all types of systolic bruit, soft and blowing, harsh and musical, "conducted" or otherwise; the character of the sound is no criterion as to its significance.

Nor is the location of the systolic murmur a reliable sign. The commonest apical systolic murmur is a cardiorespiratory sound, in reality a breath sound broken into two or more short murmurs. It is frequently associated with rapid heart action, but may be heard in slow hearts; it is not necessarily confined to inspiration. It is sometimes conducted into the axilla and may be heard even at the angle of the left scapula. If it is due to regurgitation, it is impossible to tell from the murmur alone if it is due to a lax mitral ring or a deformed valve cusp. If it is due to the former, it betokens a weakened myocardium, but there are much more reliable signs of this. If it is due to a deformed valve cusp and no signs of stenosis are present, it is of little or no consequence if none of the reliable signs of heart disease is present.

There was a time, not long since, when mitral regurgitation was a fashionable diagnosis, but it is now clear that, even in the hands of experts, the diagnosis of mitral regurgitation is uncertain, if not impossible. Mackenzie relates how Graham Steel startled him nearly forty years ago by stating that no one ever died of mitral regurgitation and of the steps which led him to confirm this opinion. Even if mitral reflux does occur at a lax mitral ring, it is an insignificant matter. It is the hypertensive heart disease, the auricular fibrillation, the anæmia or the widespread infection *et cetera* which was the real cause of death and not the relaxation of the mitral ring which they caused.

Cabot, in an analysis of 1,846 necropsied cases of heart disease, came to the following conclusions on mitral regurgitation:

(1) "Mitral regurgitation without stenosis is the commonest diagnosis now made by American physicians in cases of real or suspected heart disease.

(2) "This lesion is exceedingly rare *post mortem*; only seven cases, three of them doubtful, were found in 1,846 necropsied cases of heart disease.

(3) "Even in rare cases, where mitral regurgitation without stenosis does exist, there are no physical signs by which it can be reasoned out, so that a diagnosis of mitral regurgitation without stenosis is never justified.

(4) ". . . for the happiness and comfort of all concerned it is essential that we should get this matter straight."[6]

Systolic murmurs at the base of the heart are of no greater significance, when no other signs of heart disease are present. They are useful in reminding the physician to determine if a thrill is present, should he have neglected to do so, but of themselves, no matter what their character, they are not evidence of stenosis of either aortic or pulmonary valves.

Tricuspid systolic murmurs are heard frequently in normal people.

But it is a different case with diastolic murmurs. If a definite diastolic murmur is present at the base or at the apex, it is much more likely to be significant of disease than is a systolic murmur, if the examiner can be certain it is endocardial. But it is not often that the diagnosis rests on the murmur alone. Aortic regurgitation in most instances has the other characteristic signs of water-hammer pulse, relatively low diastolic pressure, cardiac enlargement and a history of acute rheumatism or syphilis. Yet in rare instances, when the amount of reflux is small and the arterial and the cardiac signs of regurgitation are inconspicuous, a diastolic aortic murmur, usually heard better to the left than to the right of the sternum, may be the only sign of early incompetence, but it is doubtful if one is ever justified in making a positive diagnosis of aortic regurgitation on such evidence alone.

Mitral stenosis should never be diagnosed in the absence of a diastolic murmur. Sometimes the murmur is so slight that it can be detected only by ausculation after exercise and change of position, especially lying on the left side.

Irregularity of Rhythm.

In the scope of this article the whole question of arrhythmia cannot be discussed.

Arrhythmia, when it arises from auricular fibrillation (or flutter) and *pulsus alternans*, is an indication of organic heart disease.

When due to extra systoles, paroxysmal tachycardia or atrio-ventricular rhythm, it may be, but is not necessarily, associated with organic disease. If it is, the recognition of this comes from the signs other than the arrhythmia. These conditions may occur in the normal heart.

When the irregularity arises from sinus arrhythmia or sino-auricular block, no suspicion of organic disease need be harboured.

The recognition of the type of arrhythmia can sometimes be made only after a study of the electrocardiogram, but this is not necessary in all instances. There are certain salient characters of some arrhythmias which make the diagnosis possible without instrumental examination, and some of these arhythmias are among the chief reliable signs of heart disease.

Auricular Fibrillation. Auricular fibrillation never exists without disease of the heart muscle. When present, it is usually accompanied by manifest signs of disease or by heart failure. As reliable diagnostic phenomena, it is to be noted that:

1. It is the commonest irregularity associated with insufficiency of the heart.

2. It is usually associated with a rapid heart. It is substantially true to say that it is the only irregularity accompanying heart rates of over 140 per minute, and it is the only irregularity at all common in rates of over 120. If the heart rate is below this figure and auricular fibrillation is suspected, the irregularity persists if the rate is raised to over 120 by exercise or otherwise. It is the only arrhythmia which behaves in this fashion.

3. Except in the exceedingly rare instances of paroxysmal auricular fibrillation which sometimes occur, it is a persistent condition uninfluenced by respiration, posture, activity or sleep.

4. The irregularity is a gross one, both in time and force, and a pulse deficit is usually present. A pulse deficit may be detected by noting the absence of some of the heart beats at the wrist as one palpates the pulse and simultaneously listens over the apex with the stethoscope. A pulse deficit may be present, however, in arrhythmia due to extra systoles, and in very rare cases of *pulsus alternans*, in which the weaker beats are not palpable at the wrist, though recognizable by auscultation over the apex.

Extra Systoles. Extra systoles are next in order of frequency as causes of arrhythmia, but they are not necessarily signs of a heart condition which is untoward for the patient. If they occur in conjunction with heart disease, the fact is recognized by other symptoms or signs of cardiac disability. However, they may cause an irregularity which must be distinguished from that of auricular fibrillation. The intermittency of the pulse (the extra systole being represented by a beat out of time or by an intermission) may be at regular or irregular intervals or may group the pulse into twos or threes.

Extra systoles are recognized by the following criteria.

1. They disappear when the pulse rate rises to 140 or even to 120, either from exercise or otherwise. They are rarely present in hearts beating at rates over 100.

2. They are not characteristically associated with the failing heart.

3. They are variable in occurrence, frequent at one time, few or absent at another.

4. On auscultation, a dominant rhythm is found and the extra systole can usually be recognized, followed by a longer pause than in normal rhythm.

Some rare forms of arrhythmia (for example, dropped beat of partial heart block, sino-auricular block *et cetera*) may be mistaken for extra systoles, but they are of very rare occurrence and can only be diagnosed after electro-cardiographic examination.

Paroxysmal Tachycardia. Paroxysmal tachycardia is a clear cut clinical entity. There is invariably a striking history of an abrupt onset and (except rarely) an equally abrupt offset of rapid heart action. The heart rate is regular and usually lies between 140 and 200 per minute. The rate is regular and constant, being approximately the same at all times during the paroxysm. The attack may last a few minutes or for hours or days. It is generally repeated. If it lasts more than fourteen days, the paroxysm is probably due to auricular flutter and is not a true paroxysmal tachycardia.

It is not associated necessarily with organic heart disease. "It can safely be asserted that at autopsy the pathologist, unaware of the clinical history, finds nothing that leads him to say this patient was affected by paroxysmal tachycardia."[6] If it is associated with organic disease of the heart, this is recognized by other signs. In most instances no recognizable structural damage is present and the prognosis for life is favourable.

Auricular Flutter. If auricular flutter is present, the heart is usually organically diseased, but there are no structural lesions to which it can be ascribed definitely. It is essentially similar to auricular fibrillation and is frequently a half way house to that condition. The rhythm is usually regular. When irregularity is present, it is not gross. The rate varies from normal to 160, commonly between 110 and 160. The rate is fixed as in paroxysmal tachycardia and is unaffected by those influences which accelerate or retard normal rhythm (exercise, rest, posture, excitement *et cetera*). There are usually symptoms of heart failure. It may be paroxysmal and must therefore be differentiated from paroxysmal tachycardia, but it is a much rarer arrhythmia. Its certain recognition can be made only by the study of the electro-cardiogram, but the longer duration, the generally slower pulse rate and the response to digitalis or quinidine will enable the distinction to be made in many instances.

Heart Block. Complete or auriculo-ventricular block in which the auricle and ventricle beat at different rates is the only kind of block whose presence may be suspected without electrocardiographic examination. Errors are frequent, however, in diagnoses made without graphic methods.

A pulse rate of less than forty is usually due to heart block. Other conditions causing it are so rare and detectable only by graphic methods that they may be disregarded by the general practitioner.

A pulse rate of between 40 and 60 may be due to heart block, simple bradycardia (physiological) or some rare causes only recognizable in an electrocardiogram. It is not wise to diagnose heart block when the rate is over 40 without an electrocardiogram.

In a favourable instance for diagnosis by ordinary clinical methods the pulse rhythm is regular, the rate not over 40 per minute and auricular sounds are faintly heard over the base with the stethoscope and the difference in auricular and ventricular rates may be detected by seeing

the more rapid auricular waves in the neck veins and feeling or hearing the ventricular contractions at wrist or apex.

An Adams-Stokes phenomenon sometimes occurs at the initiation or during the course of heart block. It is associated with standstill of the ventricles. If the ventricle ceases to beat for more than ten seconds, the cerebral anæmia causes giddiness, then loss of consciousness, and if for more than fifteen seconds, convulsions as in an attack of major epilepsy.

If the standstill continues, the patient dies, but if the ventricle resumes its contraction the patient quickly recovers.

When a patient describes a sudden loss of consciousness during which he falls down and immediately recovers, the possibility of heart block must always be considered.

In some instances repeated attacks of convulsions occur until the ventricle begins to contract regularly.

Such attacks may be distinguished from true epilepsy by the facts that usually the tongue is not bitten or the urine and fæces passed during the attack, and from ordinary syncope by the fact that in the latter condition the heart rate is not sufficiently slowed (usually about fifty).

Pulsus Alternans. The recognition of *pulsus alternans* can be made most certainly by the polygraph, but in well marked instances it may be detected while taking the blood pressure. *Pulsus alternans*, or alternation of the ventricles, is a state in which the pulse is regular, but consists of a strong beat followed by a weak one. In examining the blood pressure when alternation is marked, as the pressure rises in the cuff, the number of pulse beats is halved before the pulse finally disappears, a difference of from ten to thirty millimetres of mercury existing between the pressure of neighbouring beats. When *pulsus alternans* is accompanied by no other symptoms or signs of heart disease it has no significance, but when such signs are present it indicates a sinister condition. Lewis has called it under such circumstances "the faint cry of an anguished and fast failing heart muscle."[7]

Ventricular Fibrillation. Ventricular fibrillation is a terminal phase of grave organic disease and calls for no discussion here.

Distinct Over-Distension of the Veins of the Neck.

In the normal person lying at ease there is sometimes to be observed a soft filling of the veins of the neck with the characteristic fluctuations of the venous pulse. This is sometimes visible at the root of the neck, even when the patient is standing. But when the right auricle is engorged the veins of the neck become over-distended to a degree which is easily and definitely recognizable. This sign is of far greater consequence than any actual or supposed displacement of the right margin of cardiac dulness. "It is an unmistakable phenomenon, one of those emphatic and legible signs of which we possess no surplus."[8]

Expansile Pulsation of the Liver.

Expansile pulsation of the liver is a sign of advanced heart failure, said by Mackenzie to be observed most frequently in heart failure from auricular fibrillation.

Generalized Arteriosclerosis and High Blood Pressure.

The commonest cause of myocardial damage operating in adult life, and discussed later under "myocarditis," is generalized arteriosclerosis with high blood pressure.

Unreliable Symptoms and Signs of Heart Disease.

Many patients are condemned to an erroneous diagnosis of heart disease on the basis of symptoms and signs which, although sometimes present in organic heart disease, are found frequently in persons with normal hearts.

Such symptoms are pain, palpitation, fainting, dizziness, feeling of suffocation, exhaustion and slight degrees of breathlessness. None of these of itself justifies a diagnosis of heart disease.

The most important is pain. As has been pointed out earlier, pain may in some instances be the main evidence upon which the diagnosis is based. The characteristics of true cardiac pain have already been described. It may be repeated that pain over the apex is not significant of organic disease unless accompanied by one of the "chief reliable signs." If the pain is substernal, it may be unaccompanied by a reliable sign in patients beyond forty years of age and yet have grave significance. In this regard the electrocardiograph is of great value, since in about 70% of such patients definite evidence of damage to the myocardium is written in the electrocardiogram.[9]

"Fainting is as rare in heart failure, contrary to popular belief, as it is frequent in vasomotor neuroses."[10] It is a good general rule that fainting never occurs as the result of heart disease without other outspoken evidence.

Palpitation is rarely an initial symptom of heart failure, but is common in the neuroses.

There are also many physical signs which are unreliable as evidence of heart disease. Among these are slight thrills, diffuse cardiac impulse, systolic murmurs, cardio-respiratory murmurs, the so-called "weak heart sounds," reduplication of first or second sound, normal protodiastolic gallop (third sound) in the young, sinus arrhythmia (respiratory or phasic) tachycardia of mild degree and inconstant rate and arrhythmia due to extra systoles in hearts which give no reliable evidence of organic disease.

Epigastric pulsation is a sign which has to be interpreted with extreme caution, and œdema of the legs has inflicted on many a patient with varicose veins or anæmia or rheumatism and on many a rotund lady in the height of summer, an erroneous diagnosis of early heart failure.

Coronary Occlusion.

We now recognize coronary occlusion as a distinct clinical entity. This is the outstanding recent addition to our knowledge of heart disease. It occurs particularly in men over the age of forty and is characteristically sudden in onset and not related to effort. Death occurs at once or in a few hours in about 50% of cases only. In those patients in whom sudden death does not occur, intense pain is the outstanding symptom. Agonizing in character, it may be substernal or epigastric. It lasts usually for hours or days and severe dyspnœa accompanies it. Vomiting is frequent, the pulse becomes feeble, rapid and often irregular, fever and leucocytosis develop some hours afterwards, the blood pressure is often suddenly lowered, weak heart sounds, a gallop rhythm and pericardial friction may appear, and congestive heart failure often follows. Sometimes pain is absent, the onset being marked by collapse and dyspnœa. Electrocardiographic examination in most instances shows characteristic changes in the ventricular complexes. The reader unfamiliar with the work published since 1928 describing the clinical features of coronary occlusion is recommended to consult a recent text book.

Coronary occlusion must be differentiated from *angina pectoris*, acute abdominal catastrophes and pneumonia.

The pain of *angina pectoris* is clearly distinguishable because of its onset usually after exertion, its shorter duration (minutes only) the absence of severe shock and dyspnœa, the unchanged character of the pulse and heart sounds, and the lack of pyrexia, leucocytosis and blood pressure changes. Congestive heart failure does not follow angina.

Myocardial Lesions.

Myocarditis, as a clinical diagnosis, has been much abused. "In some instances it would seem reasonable to suppose that the user's mind worked somewhat as follows: 'I think there is something wrong with the heart. I can't hear any murmurs, so I can't blame it on a valve lesion; I don't know what the trouble is, so I guess I'll just say it is myocarditis.' Thus the term myocarditis has been applied to cases of cardio-vascular syphilis, senescent heart disease, hypertensive heart disease *et cetera*, and even to cases in which the heart is normal. In this sense myocarditis has at times been used as a waste-basket diagnosis."[11] That myocarditis exists commonly is undoubted, as every pathologist knows, but as a clinical diagnosis the term should be used circumspectly, as part only of a larger diagnosis. It is the predominant feature in rheumatic heart disease, syphilitic heart disease and hypertensive heart disease, but its presence should never be diagnosed in the absence of some of the reliable symptoms and signs already detailed.

The presence of an ætiological factor is of importance. Especially is this the case when marked coronary disease, arteriosclerosis or hypertension or undoubted valvular lesions are present.

It is not uncommon to meet a diagnosis of myocarditis based on symptoms in a patient whose heart is normal on examination. A guiding principle is that in the absence of one of the "chief reliable signs" or of anginal pain the myocardium of young people may be pronounced sound whether breathlessness is present or not. Also the myocardium may be pronounced sound in patients of all ages when exercise tolerance is good. But if the reaction to exercise is not good in patients over forty years of age, and no other satisfactory cause for this is discoverable (for example, pulmonary disease), the heart muscle should not be pronounced sound, even if there are no physical signs of disease. Breathlessness of cardiac origin is common in old men who present no signs of structural heart change.

Altered heart sounds ("weak sounds," systolic murmurs, reduplications *et cetera*) should never be used alone to diagnose myocardial disease. Where they exist in diseased hearts they are accompanied by other definite signs or symptoms of heart disease.

The diagnosis of "myocarditis," therefore, is one not to be made at random. It should never be made unless the evidence is reliable and clear in the mind of the examiner. It is preferable that it should be a part of a larger diagnosis, such as, for example, "the myocarditis of hypertensive heart disease."

"Fatty Heart." The name fatty heart has now disappeared from medical literature. The pathologist and the clinician have come to doubt the disease significance of depositions of fat in the heart and regard the term "fatty degeneration" as a misnomer. With more precise knowledge the "fatty heart" of our fathers has been lost, mainly in the condition of hypertensive heart disease, just as the "fibroid heart" has disappeared with the clearer recognition of the causes of degenerative changes in the myocardium.

"Heart Strain."

While "myocarditis" is a diagnosis which is somewhat suspect because it is too vague and the "fatty heart" and the "fibroid heart" are completely in the discard, "heart strain" is still with us, although it should have been the first of these names to disappear.

"Heart strain" is a diagnosis which is often given, one suspects, to satisfy the patient's views. But it is doubtful if the layman's vague ideas on this matter are more vague than those of some medical men who permit the term. This term and "irritable heart" are frequently used loosely to label ailments the nature of which is imperfectly understood. This diagnosis is very frequently made in patients suffering from neurosis.

The healthy heart is able to withstand all "strains" or demands made upon it, no matter how extreme the degree of physical effort. It is protected by the fibrous pericardium, but, more importantly, by the fact that the full supply of blood to the somatic muscles and the excretion of lactic acid products formed by the muscles will fail before the heart, if the call is excessive. It has also been shown that a breakdown of the respiratory functions with complete failure to eliminate carbon dioxide will protect the healthy heart from damage by excessive exertion. The idea that the healthy heart will be damaged by excessive physical work is a relic of the old tradition, now moribund, that the first and last cause of heart failure is a mechanical defect.

Lewis summarizes his experience by saying: "If strain of the healthy heart exists, it is no more than a curiosity."[13]

Therefore one has only to consider the effect of strain on the diseased heart, that is, the damaged myocardium. An unhealthy state of the myocardium may be due to a present infection which may be so slight as a mildly pyrexial attack of tonsillitis or influenza. Or it may be due to the effects of an old infection, such as rheumatic fever. From such causes as these, the myocardium may be so weakened as to reduce its capacity for withstanding mechanical strains. The strain may be sudden or long

continued. It is the sudden onset of heart failure which is of most importance to discuss from the point of view of diagnosis.

Sudden effort in some instances appears to precipitate the onset of heart failure. In a patient with damaged heart muscle whose cardiac reserve power is lessening, it is not surprising that his first distress should come at a moment of severe exertion; at such a moment his reserve power is called upon and is found wanting. It is the progressive changes in the myocardium which are the predominant feature and not the physical exertion. In other instances the onset of auricular fibrillation occurs after a severe effort and is followed by heart failure. It is possible that the increased heart rate is the means by which auricular fibrillation is produced by severe effort in patients whose auricular muscle is ready to fibrillate. Mackenzie states that: "Every case of heart failure with respiratory distress from what is called 'heart strain' which followed some extra effort that I have seen, could be attributed to the onset of auricular fibrillation or its allied condition, flutter."[13]

Where the strain is a long continued one, as, for example, when a patient with mitral or aortic disease with the associated myocardial changes engages in heavy manual work, the time of ultimate failure may be hastened. Such a heart is bound to progress deliberately to failure under any circumstances. If the patient performs heavy manual labour, he makes greater demands on his reserve power, he uses it up more quickly and it disappears earlier than if he had lived an easier physical life.

In the writer's opinion it is impossible to evaluate the effect that the continuous heavy physical work has had in such patients in hastening the time when heart failure occurs.

"Heart strain" does not occur, therefore, in the healthy heart. If strain plays any part in producing heart failure, it does so only in the diseased heart, the underlying damaged condition of the myocardium being the predominant factor.

In most instances, however, the diagnosis of "heart strain" has been given to patients with healthy hearts, but unhealthy nervous systems, victims of a cardioneurosis. The story is nearly always that during a severe effort, usually when the arm and shoulder muscles are being used, the previously healthy patient feels pain in the precordium (over the apex of the heart) and often dizziness. Although this may be due to strain or fibrositis of the superficial muscles of the thorax, the patient fears that he has "strained his heart." He consults a doctor and his fears may be confirmed by an erroneous diagnosis. Shortness of breath appears and an unstable tachycardia. In fact, he develops many or all of the unreliable symptoms of heart disease—he becomes "heart conscious." His cardioneurosis, when fully established, is difficult to combat, especially if he is a claimant under the *Workers' Compensation Act.*

"Acute Dilatation of the Heart."

A diagnosis of acute dilatation of the heart is frequently encountered and sometimes betrays a misconception of the real nature of the phenomena. It frequently arises from the conviction that a pathological sudden dilatation of the heart may occur and cause grave symptoms of heart failure.

In the healthy heart dilatation probably occurs during exertion, as shown under experimental conditions by Starling, but this is a physiological and not a pathological process. It is a temporary change, because the heart of the healthy person has been shown by accurate investigation to return immediately after exercise to a condition in which it is rather smaller than before exercise. It has been pointed out in discussing "heart strain" that Nature has provided the healthy heart with efficient safeguards. There is no evidence that a pathological acute dilatation of the healthy heart does occur.

It is doubtful also if an acute (sudden) dilatation of the diseased heart occurs except as a phenomenon secondary to some other cause. Many believe that heart failure sometimes arises suddenly from this cause, as, for example, after surgical operations. It is now known that the undoubted dilatation present in such patients arises as the

result of the sudden onset of arrhythmia; this primary condition causes gross over-action of the heart which in its turn produces sudden dilatation. It is important to recognize that dilatation of the heart is not the cause of a rise in the heart rate. It is sometimes an effect, however. An accurate knowledge of the signs and symptoms of the arrhythmias will enable a true diagnosis to be made.

In this discussion it must be clearly kept in mind that sudden dilatations only are under consideration. Dilatation of the heart, other than acute, is commonly one of the many phenomena of heart disease and heart failure.

The Cardiac Neuroses.

More errors in the diagnosis of cardiac disease arise from a failure to distinguish the neuroses from organic disease than from any other cause, and the patient is indeed the sufferer.

In this article an attempt has been made to indicate the criteria upon which recognition of the neuroses rests. A clear understanding of the significance of symptoms and signs, of those which are reliable and those which are not, is the main necessity. As soon as it is recognized that precordial pain and hyperæsthesia, shortness of breath, dizziness, tremor of the hands, with cold, clammy hands and even cyanotic fingers, and an unstable tachycardia unaccompanied by definite reliable signs, are not suggestive of heart disease, most of the difficulties disappear. Among those physical signs which have been responsible for confusion, the commonest have already been discussed. They are increased but variable heart rate, systolic murmurs, diffuse apex beat, weak heart sounds, reduplicated heart sounds and exaggerated lack of exercise tolerance when no other sign of organic heart disease is present ("effort syndrome").

The only real difficulty in diagnosis is presented by hyperthyreoidism. The three important factors are, when doubt exists, the nature of the tachycardia, the determination of the basal metabolic rate and the result of treatment at rest.

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British Medical Association News.

SCIENTIFIC.

A MEETING OF THE OBSTETRICAL SECTION OF THE QUEENSLAND BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the B.M.A. Building, Adelaide Street, Brisbane, on October 28, 1930, DR. F. A. HOPE MICHÔD, the President, in the chair.

The second and third quarterly reports were presented to the meeting and adopted.

Several case histories were then read in detail and discussed.

Eclampsia.

Mrs. M.F., an Australian, aged twenty-three, a *primipara*, was admitted to hospital semiconscious and quite blind. She had been sent in from the country by a doctor who said that she had had no antenatal supervision. Her first fit occurred at 4 a.m. on May 13, 1930, and was followed quickly by four more. On admission to hospital her temperature was 38·3° C. (101° F.), her systolic blood pressure was 170 millimetres of mercury, her pulse rate 120 and her urine became solid on boiling. She had another four fits and did not regain consciousness. She was treated by colon irrigations and washing out of the stomach, magnesium sulphate being left in the stomach. She appeared dangerously ill and was getting rapidly worse, so that a Cæsarean section was decided upon. Before operation could be commenced she had a fit, in which she went quite black in the face and stopped breathing and she appeared to have died. Artificial respiration was performed and breathing recommenced. Thirteen hours after the first fit operation was performed. A small amount of ether was used for anæsthesia and the classical Cæsarean section was done. The abdominal wall was very œdematous and much serous fluid came from the incision. Both ovaries were enlarged and œdematous, resembling two big sausages, being about 11·25 centimetres (four and a half inches) long and five centimetres (two inches) in diameter. She improved rapidly after operation and seven hours later was able to talk when roused. On the following morning she spoke rationally and her sight began to improve. She then recovered rapidly and on leaving hospital her systolic blood pressure was 140 millimetres and there was only a trace of albumin in the urine. Her puerperium was uneventful, the child survived and lactation was established.

Pelvic Deformity.

Mrs. F.F., an Australian, aged thirty-eight, was in her first pregnancy. There was considerable pelvic deformity and X ray examination revealed the left hip and thigh ankylosed in a flexed position. When the left foot was on the ground she was bowed forward and her head was barely four feet from the ground. The external pelvic measurements were as follows: Interspinous, 18 centimetres; intercristal, 22 centimetres; external conjugate, 14 centimetres. The true conjugate was estimated to be 5·6 centimetres. She had had a severe illness when she was ten years of age, probably due to acute osteomyelitis of the pelvis. She was admitted to hospital in labour and Cæsarean section was performed twelve hours after its commencement. The classical operation was done and convalescence was uneventful. The child was delivered alive and weighed 2·9 kilograms (six and a half pounds).

Tuberculosis.

Mrs. M.C., an Australian, was in her fourth pregnancy. This patient was suffering from pulmonary tuberculosis and had been under treatment by artificial pneumothorax all through her pregnancy. The first stage of labour lasted ten hours and the second two hours. She was delivered naturally of a female child which was full term, weighed 2·9 kilograms (six and a half pounds), but was still-born. The placenta was adherent and was manually removed on account of hæmorrhage one and a half hours after the second stage. The puerperium was uneventful.

A Case for Diagnosis.

Mrs. K.M.W., an Australian, aged twenty-five, was in her third pregnancy. Her previous obstetrical history showed that she had a long labour with her first child four years before, the perineum being badly torn; a considerable amount of blood was lost before delivery of the placenta. Her second confinement, two years before, was accompanied by albuminuria and œdema. An infant, four kilograms (nine pounds) in weight, was born by the aid of forceps and the perineum was badly torn again. Her puerperium was morbid. During the present pregnancy she had been

weak and anæmic, but was delivered of a full term child without instrumental aid after a normal labour. The child weighed 2·5 kilograms (five and three-quarter pounds). Profuse bleeding started five minutes after the birth of the child. The placenta began to separate within ten minutes, but as abdominal pressure could not deliver it and as the patient was losing blood freely, a hand was inserted into the vagina, when it was found that half the placenta was outside the external os. Traction by means of the hand in the vagina was successful in bringing it away, but the hæmorrhage was still severe and necessitated bimanual compression of the uterus before it could be controlled. The puerperium was prolonged. The temperature rose on most evenings to 37·8° C. (100° F.). Pelvic examination revealed no abnormality and she was allowed to return to her home during the third week, although she complained of pain in the right side of the lower part of the abdomen. In a few days she was very ill, with a high temperature, severe pain in the left thigh, and her left leg became very swollen and painful. She was readmitted to hospital in a very serious condition and was given "Radiostoleum" in two drachm doses by the mouth. Her general condition began to improve at once and in three weeks her left leg had almost regained its normal condition. She had then a sudden onset of severe pain in the right leg and became very ill again. The whole of the right leg became swollen, painful and tender, and "Radiostoleum" was again administered with consequent improvement. She was able to return to her home about twelve weeks after the onset of labour and then no abnormality could be detected. Six weeks after this she was well, but a little weak in walking.

Abscess in the Pouch of Douglas.

Mrs. I.R., of Australian nationality, aged twenty-three, was in her seventh pregnancy. She delivered herself naturally of a full term baby weighing 3·6 kilograms (eight pounds) before the arrival of her medical attendant. Her puerperium was uneventful for five days, when she had an evening rise of temperature to 39·4° C. (103° F.), accompanied by offensive lochia. An intrauterine douche was given on three occasions with improvement in the patient's condition for three days. At the end of this time her temperature again rose each evening for fifteen days, on one occasion reaching 40·5° C. (105° F.). Her temperature then became normal and she was allowed to return to her home. Two days after this she had a rise in temperature with pain in the pelvis and had difficulty in defæcation. Vaginal examination disclosed a mass in the pouch of Douglas. The patient was advised to go to hospital for surgical treatment, but before she left her home the abscess ruptured into the bowel and she made an uninterrupted recovery.

Vaginal Hæmatoma.

Mrs. C.H.L., of Australian nationality, aged twenty-five years, was in her first pregnancy. Her physical condition was excellent and her various antenatal examinations revealed no abnormalities. She delivered herself naturally of a full term living child weighing 2·9 kilograms (six and one half pounds) after a labour of which the first stage was seven hours, the second stage two hours and the third stage twenty minutes. The perineum was intact and the placenta and membranes were complete. The baby was born in the morning and in the evening of the same day the patient complained of a feeling of fullness in the vagina. On examination there was a slightly bruised appearance of the perineum. This commenced to spread, and on the next day there was swelling of the perineum and vulva. Later, both *labia majora* became very swollen and œdematous. The left side was greatly discoloured and the blood spread back under the skin of the left ischio-rectal fossa and on to the thigh and buttock. It caused the patient very little pain or inconvenience and was not associated with a rise in temperature. Four days later she was able to sit up in bed, and said she felt perfectly well. Her puerperium lasted three weeks and by this time the external swelling had subsided. Vaginal examination showed that the whole of the recto-vaginal septum was occupied by a large tense swelling bulging into the rectum and vagina. In the case of the latter the swelling was so pronounced that it was difficult to force the examining finger past the swelling to reach the cervix. Seven weeks after the confinement the swelling was still present, but was reduced to about half its original size.

Medical Societies.

MEDICAL WOMEN'S SOCIETY OF NEW SOUTH WALES.

THE ANNUAL MEETING OF THE MEDICAL WOMEN'S SOCIETY OF NEW SOUTH WALES was held at the rooms of the Girls' Secondary Schools' Club, Gowings' Buildings, Market Street, Sydney, on March 30, 1931.

Annual Report and Financial Statement.

The annual report and financial statement for the year 1930 were adopted on the motion of Dr. L. Gullett, seconded by Dr. M. Little. The report is as follows:

The Committee submits the following report.
The Society has made satisfactory progress during the year.

Membership.

The financial membership stands at 74, eight new members having been elected during the year.

Meetings.

In accordance with the rules, four quarterly meetings were held and also an extraordinary meeting in August, the average attendance being thirty. This was an increase of ten over the average attendance for 1929.

Addresses and Papers.

At the April meeting an address on the work that is being done for crippled children by the medical officers of the Department of Education was read by Dr. Edelsten-Pope. The papers were prepared by Dr. Edelsten-Pope and Dr. McClemens.
At the June meeting Dr. Sandford-Morgan gave an address on "Investigations on Maternal Mortality."
At the September meeting Dr. Little gave an address on "How to Submit Specimens to a Pathologist," and Dr. Keatinge read a paper on her work in connexion with cancer research. This was illustrated with lantern slides.
All papers were much appreciated by members.

Entertainments.

On the invitation of the President, Dr. Lucy Gullett, members of the Society met at the Queen's Club, King Street, Sydney, on August 11, 1930, to entertain Professor and Mrs. J. T. Wilson, of Cambridge, and Dr. Elizabeth Hamilton-Brown, of Delhi, India.
Professor Wilson spoke delightfully on the place of women in medicine.
Dr. Hamilton-Brown spoke on some special problems in her work, especially the anæmia of pregnancy and osteomalacia.
Mrs. Wilson was presented with an etching of the entrance gates of the University from the Society, and a most enjoyable evening was spent.
At the December meeting Dr. Chapman, of New Zealand, was the guest of the Society. This meeting was a social one and was held at the Forum Club. Recent women graduates and women students in their final year in medicine were invited to be present.

Office Bearers.

The office bearers for the ensuing year are as follows:
President: Dr. L. Gullett.
Vice-Presidents: Dr. C. D'Arcy and Dr. M. Little.
Honorary Treasurer: Dr. A. Aitken.
Honorary Secretary: Dr. I. Saunders.
Committee Members: Dr. M. E. Edelsten-Pope, Dr. M. Hamilton, Dr. K. Helms, Dr. Sandford-Morgan, Dr. K. Cunningham, Dr. E. B. Durie and Dr. M. J. Hudson.

Constitution of Medical Women's Society of New South Wales.

Notice of proposed alterations to the existing constitution of the Society was given by Dr. Gullett.

An Address.

An address was given by Dr. Susie O'Reilly. She spoke of conditions at the University of Sydney when she was an undergraduate in medicine and of her experiences as a resident medical officer in different hospitals. Her address was most entertaining and greatly appreciated by members. A hearty vote of thanks by acclamation was carried on the motion of Dr. Gullett.

THE NEW SOUTH WALES MEDICAL UNION.

THE following report of the New South Wales Medical Union for the year 1930-1931 has been received.

The Council has pleasure in submitting to the members the thirty-eighth annual report of the New South Wales Medical Union for the year 1930-1931.

There are 1,286 members, a decrease of 38 members on the year. There are 86 new members and 173 life members.

The year's operations have resulted in a surplus of £95 3s. 5d. Legal expenses, including damages, have amounted to £2,266 7s. 2d. Two fracture cases set down for hearing in October, 1929, are included in the current year's accounts. One was settled out of court, the other came to trial in March, 1930. The jury, failing to agree to a verdict, was discharged. A second trial took place in December, when the jury gave a verdict for £925 for the plaintiff. It was decided not to appeal on counsel's advice.

In a third case the plaintiff withdrew her claim at the last moment, but not till the judge was actually on the bench and the jury empanelled. In this case our client had incurred heavy costs in preparing his defence.

In a fourth case our member had to answer a charge of false swearing in an action heard the previous year. This involved a whole day's attendance at the Central Police Court and representation by counsel.

In a fifth case plaintiff complained that our member had made a mistake and removed portion of the tenth rib instead of the ninth, whereby he had suffered serious mischief in an operation for the relief of pain after fractured rib. Plaintiff lost his case and our member was acquitted of all blame. In addition to these, in a number of other cases advice was given and litigation averted.

The Council decided not to call on life members to pay the annual subscription for the current year. Should the financial position require it, however, the Council may have to reimpose the subscription in future years. As mentioned in the last annual report, the Council has made an arrangement with Lloyd's, London, by which members may get cover up to £10,000 in any one case.

The Council desires to urge all medical practitioners who have not joined the union to consider seriously the risks they run. Members of the union should consult the secretary directly they find themselves in a difficulty, and before taking any action. Cases are sometimes prejudiced by delay and other unwise procedure on the part of members before advice is sought from the officers of the union. In doubtful cases the wise practitioner will never refuse and often demand a consultation.

The Council again wishes to impress upon members the importance of an X ray examination in all cases of possible fracture, dislocation, foreign body et cetera. Neglect of this precaution is apt to be looked upon unfavourably in a court of law. The Council will take any such neglect into account in deciding what assistance, if any, to grant. If an X ray examination has been advised and not carried out, the member should see that this advice is properly put on record.

The Council records with regret the death of Dr. A. S. Vallack, Dr. R. L. Faithfull, Dr. R. W. Young, Dr. A. G. S. Gilchrist, Dr. J. K. Darton, Dr. C. S. Browne, Dr. G. P. Stanley, Dr. K. M. Garrett, Dr. David Thomas and Dr. E. H. Thane.

Dr. Faithfull had been a member of the Council since the inauguration of the union in 1893. He retired in 1929 owing to failing health. A very regular attendant at the meetings, he took a keen interest in our progress. His wise advice and kindly nature were greatly appreciated.

Dr. David Thomas was a member of the Council from 1910 to 1925, when he retired on account of ill health. He was a man of strong personality and rendered valuable service to the public of New South Wales in many ways.

Obituary.

JOHN ADRIAN LYNCH.

DR. JOHN ADRIAN LYNCH, whose death was announced in a recent issue of this journal, was born near Warracknabeal, Victoria, on January 5, 1902. He was the son of Mr. T. Lynch, a teacher in the Department of Education, from whom he received his early education. He was industrious at school; he won several scholarships offered by the Department of Education and finally entered Newman College as an undergraduate in medicine. He graduated with honours as Bachelor of Medicine and Bachelor of Surgery in 1925. After a period of one year as resident medical officer at Saint Vincent's Hospital, Melbourne, he became assistant to Dr. T. P. Noonan, of East Malvern. After this he was appointed Medical Superintendent in the service of the Brisbane and South Coast Hospitals Board. In 1930 he returned to Melbourne and took over the practice of Dr. F. Cotter at East St. Kilda. He was successful in practice and won the esteem of his fellow practitioners; his personal charm won him many friends.

Dr. D. Murray Morton writes:

In expressing my very deep regret at the untimely death of Dr. John Adrian Lynch, I am confident that I am also expressing the feelings of every member of the staff of Saint Vincent's Hospital, Melbourne, where Dr. Lynch was a brilliant student and a most capable house surgeon.

In addition to ability and reliability in the work of the hospital, Dr. Lynch was gifted with an attractive personality, a sunny disposition and great energy. By his early death the medical profession has suffered the loss not only of an able exponent, but also of one whose cheerfulness and humanity carried him far towards the ideal of the doctor as a consoler as well as a healer of human suffering.

CORNELIUS GEORGE CROWLEY.

WE regret to announce the death of Dr. Cornelius George Crowley, which occurred on May 9, 1931, at Malvern, Victoria.

Correspondence.

SCARLET FEVER IMMUNIZATION.

SIR: Your correspondent "Dickens" (THE MEDICAL JOURNAL OF AUSTRALIA, May 9, 1931, page 589), in referring to this hospital (as presumably he does by an inaccurate title), seems not to have taken much trouble to inform himself as to the performance of Schick and Dick tests therein. The practice he lauds as having "been in vogue in America and enlightened European countries for at least three years," has been routine for the medical and nursing staffs of this hospital for the last seven years as regards Schicks, as reference to the annual reports would have shown. Dicks are of less importance to us, but have been done whenever occasion required since 1929.

His "verbal offer" to perform this service is unknown to the authorities, but obviously, if aware of it, they would not think it necessary to encourage interference in a

matter with which their own staff are regarded as fully competent by long practice and probably more familiar by hundreds of tests.

As the officers responsible for this item of the hospital's business, we offer the above amount of local enlightenment to "Dickens" as some assurance that his concern for us has been misplaced.

Yours, etc.,

F. TIDSWELL,
Director of Pathology.

S. W. G. RATCLIFF,
Medical Superintendent.

Royal Alexandra Hospital for Children,
Camperdown, New South Wales,
May 11, 1931.

Books Received.

RECENT ADVANCES IN RADIOLOGY, by Peter Kerley, M.B., B.Ch. (N.U.I.), D.M.R.E.; 1931. London: J. and A. CHURCHILL. Demy 8vo., pp. 332, with 120 illustrations. Price: 12s. 6d. net.

A SYSTEM OF BACTERIOLOGY IN RELATION TO MEDICINE (Privy Council, Medical Research Council); Volume VI; 1931. London: His Majesty's Stationery Office. Crown 4to., pp. 538. Price: 21s. net.

LATERAL CURVATURE OF THE SPINE AND ROUND SHOULDERS, by R. W. Lovett, M.D., Sc.D.; Fifth Edition, revised and edited by F. R. Ober, M.D., and A. H. Brewster, M.D.; 1931. Philadelphia: P. Blakiston's Son and Company. Royal 8vo., pp. 250, with 201 illustrations. Price: $3.50 net.

OBSERVATIONS ON THE COURSES OF DIFFERENT TYPES OF BRIGHT'S DISEASE AND ON THE RESULTANT CHANGES IN RENAL ANATOMY, by D. D. Van Slyke et alii (MEDICINE MONOGRAPHS, Volume XVIII); 1930. London: Baillière, Tindall and Cox. Royal 8vo., pp. 130, with illustrations. Price: 13s. 6d. net.

HANDBOOK OF DIETS, by R. M. Simmonds, S.R.N.; 1931. London: William Heinemann (Medical Books) Limited. Demy 8vo., pp. 115. Price: 7s. 6d. net.

PSYCHOLOGY IN GENERAL NURSING, by I. G. H. Wilson, M.D., D.P.M.; 1931. London: Edward Arnold and Company. Crown 8vo., pp. 224. Price: 5s. net.

THE PRACTICAL MEDICINE SERIES: GENERAL THERAPEUTICS; Series 1930. Chicago: The Year Book Publishers. Crown 8vo., pp. 456. Price: $2.25 net.

Diary for the Month.

MAY 26.—New South Wales Branch, B.M.A.: Medical Politics Committee.
MAY 27.—Victorian Branch, B.M.A.: Council.
MAY 28.—South Australian Branch, B.M.A.: Branch.
MAY 28.—New South Wales Branch, B.M.A.: Branch.
JUNE 2.—New South Wales Branch, B.M.A.: Organization and Science Committee.
JUNE 3.—Victorian Branch, B.M.A.: Branch.
JUNE 4.—South Australian Branch, B.M.A.: Council.
JUNE 5.—Queensland Branch, B.M.A.: Branch.
JUNE 9.—New South Wales Branch, B.M.A.: Ethics Committee.
JUNE 11.—Victorian Branch, B.M.A.: Council.
JUNE 12.—Queensland Branch, B.M.A.: Council.
JUNE 16.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
JUNE 23.—New South Wales Branch, B.M.A.: Medical Politics Committee.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser," page xvi.

DIRECTOR-GENERAL OF PUBLIC HEALTH, SYDNEY, NEW SOUTH WALES: Honorary Medical Officers.
MATER MISERICORDIÆ PUBLIC HOSPITAL, SOUTH BRISBANE, QUEENSLAND: Resident Medical Officer.
ROYAL PRINCE ALFRED HOSPITAL, SYDNEY, NEW SOUTH WALES: Honorary Vacancies.
THE UNIVERSITY OF MELBOURNE, VICTORIA: Part-Time Demonstrators in Clinical Physiology.
UNIVERSITY OF HONG KONG: Professor of Pathology.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company, Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members desiring to accept appointment in ANY COUNTRY HOSPITAL, are advised to submit a copy of their agreement to the Council before signing, in their own interests. Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Hospital. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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